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Classification of Public Domain

Bureau of Land Management
Missouri River Basin Studies
1971

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Land Planning and Classification Report of the public domain lands in the

MUSSELSHELL RIVER AREA
MONTANA

A Missouri River Basin Investigation

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DEPARTMENT OF THE INTERIOR

BUREAU OF LAND MANAGEMENT

DENVER, COLORADO

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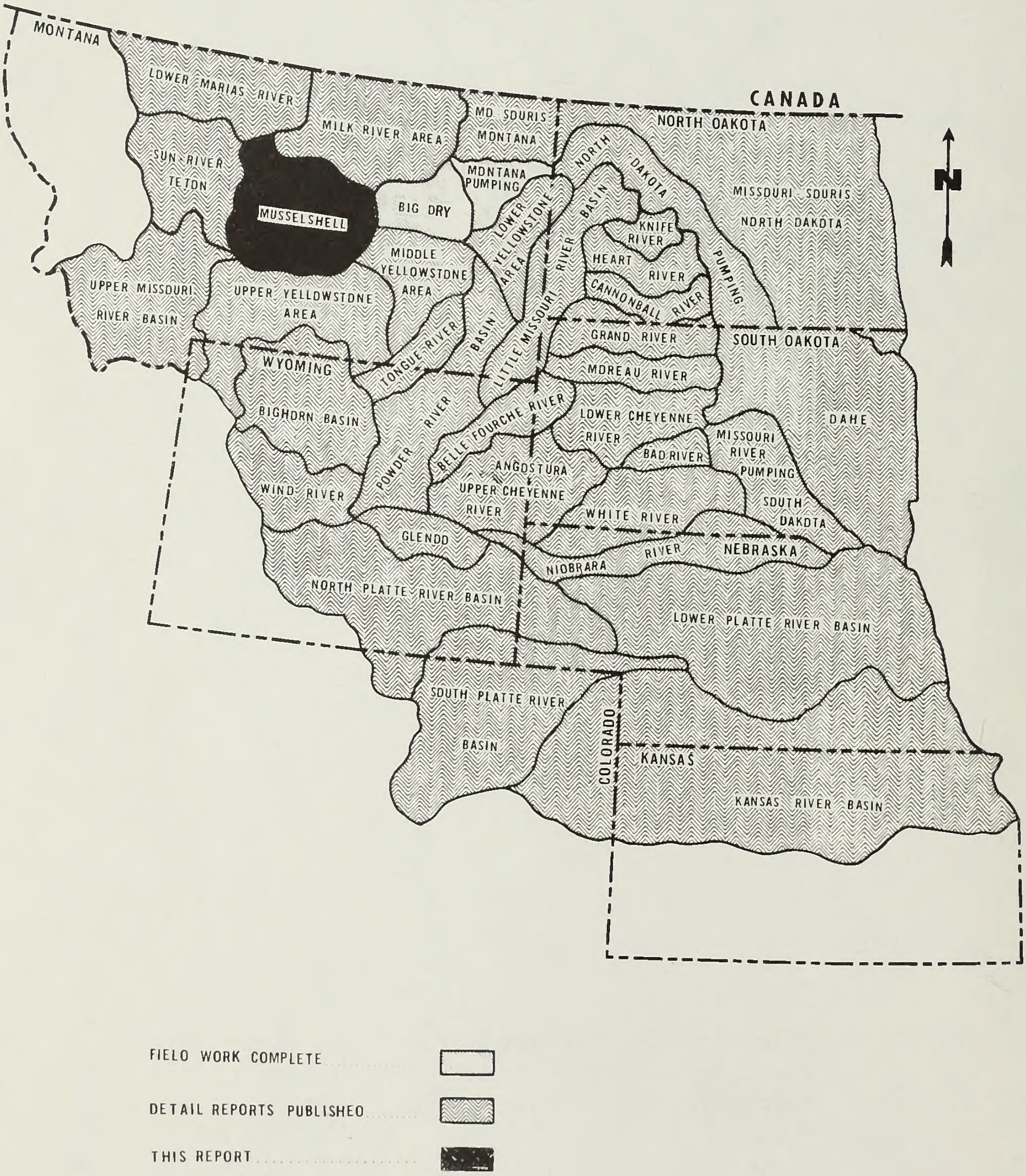
PRESENT STATUS OF BUREAU OF LAND MANAGEMENT STUDIES IN THE MISSOURI RIVER BASIN

(LAND CLASSIFICATION)

June, 1970



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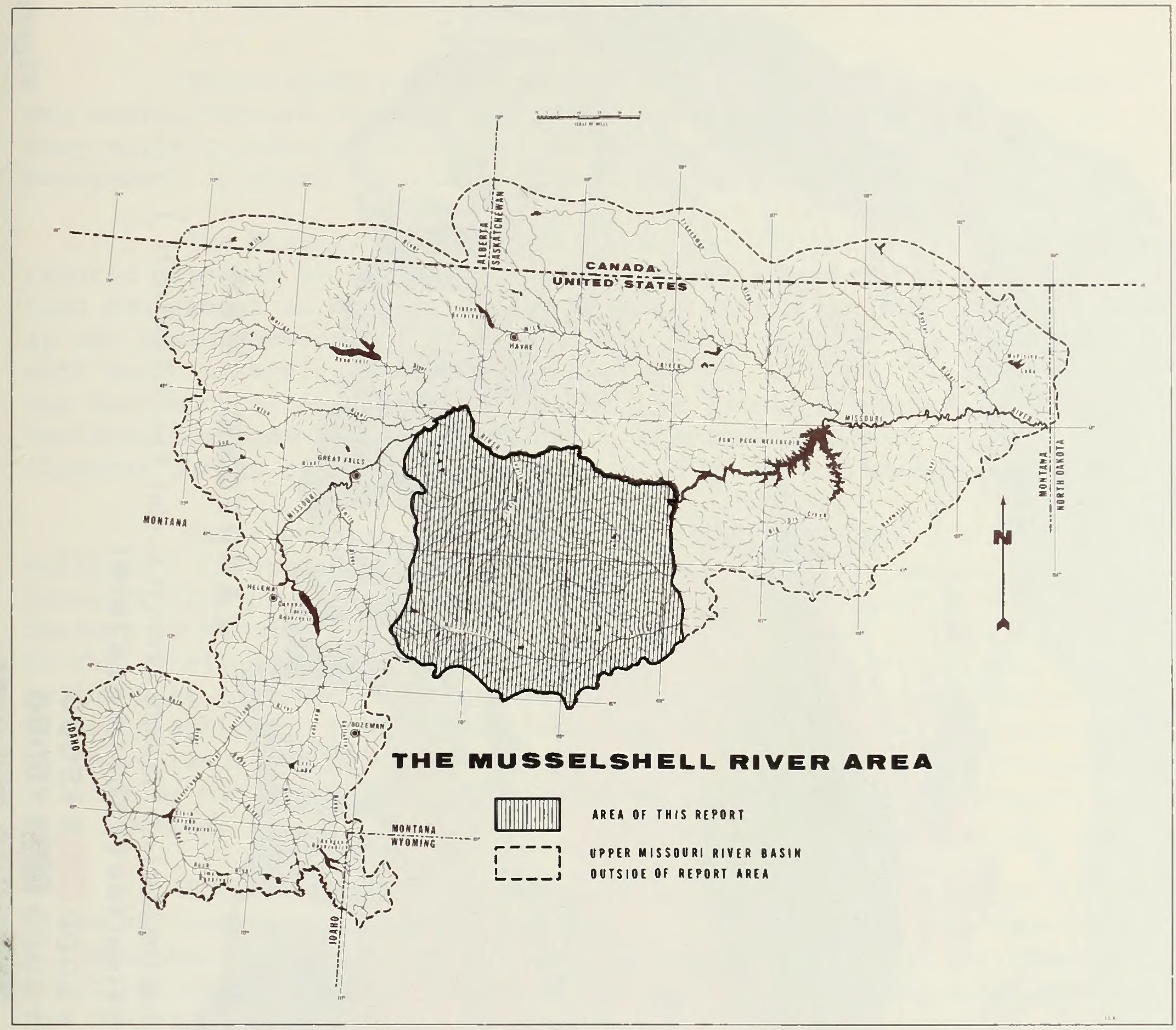
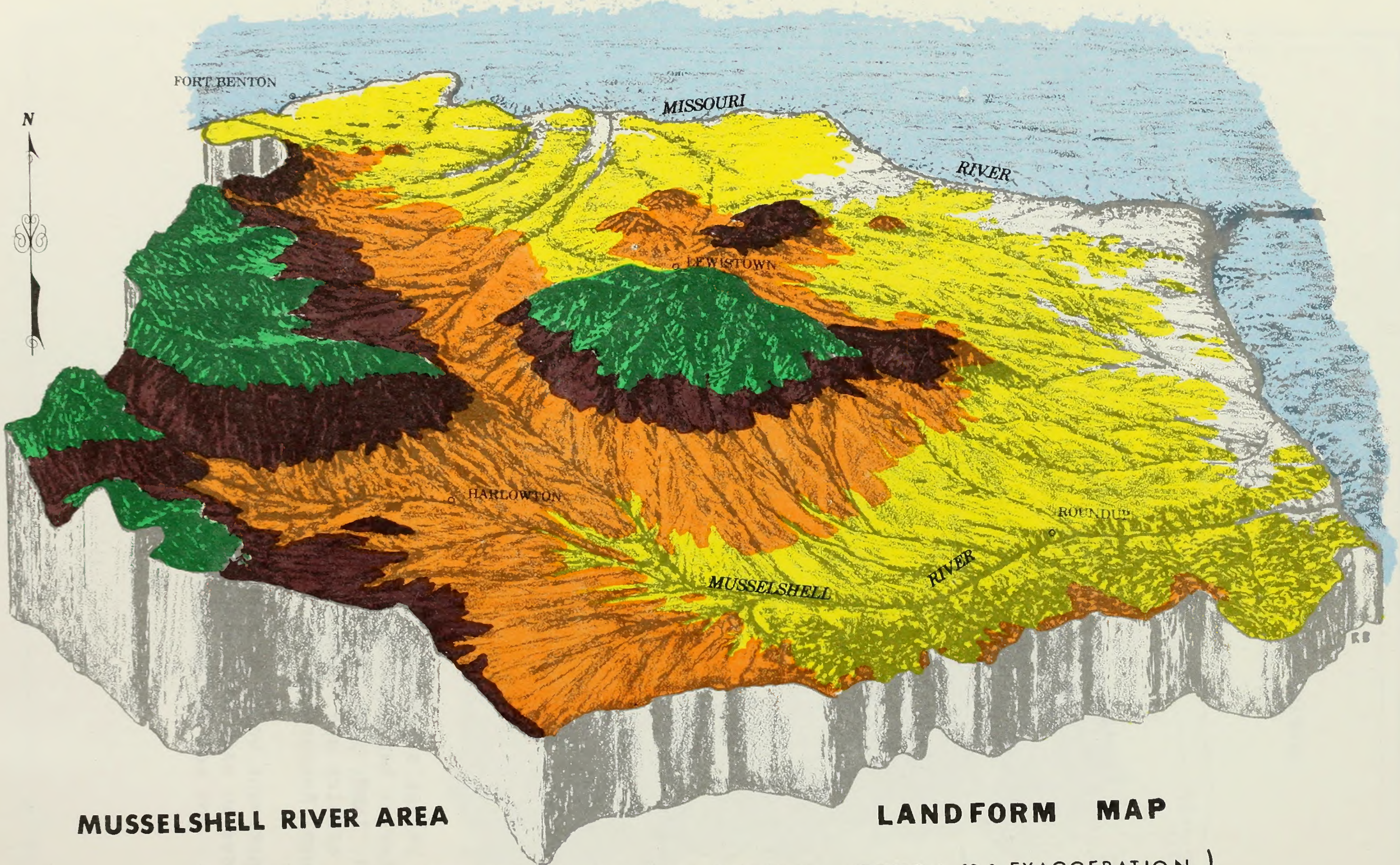


Figure 1

As the nation's principal conservation agency, the Department of The Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States - now and in the future.



MUSSELSHELL RIVER AREA LANDFORM MAP

(SCALES: —HORIZONTAL VARY (from 1 98,000 to 1· 124,000) . VERTICAL 60:1 EXAGGERATION)

Elevation (feet) above sea level

☐ 2 - 3000
🟨 3 - 4000
🟧 4 - 5000
■ 5 - 6000
🟩 6000 and over

Figure 2

FOREWORD

This report presents an analysis of the physical, economic and social factors of the Musselshell River subbasin of Montana, as they apply to the public lands administered by the Bureau of Land Management in trust for the people of the United States.

The Musselshell publication is the 34th in a series of 35 reports prepared by the Missouri Basin field group of the Bureau of Land Management in support of the Missouri Basin Project. That project is the Basin Development Program of the Department of The Interior, with basic authority in the Flood Control Act of 1944, executed by the Secretary of The Interior through the Bureau of Reclamation as construction agency. The Department, through the latter agency finances Bureau of Land Management participation by transfer of funds.

Based on historic background and detailed field studies, sufficient information is presented in this report to enable consideration of specific problems, and to permit technical recommendations to be made for management of the public lands. The purpose of the detailed study of each individual tract is to direct its use in the best interests of the public, compatible with proper conservation practices. Public agencies, both federal and local, interested in these lands are told of their location, description, and prospective utility by two means, namely this report and the detailed accounts of each isolated tract.

For each individual tract of land an inventory report was prepared, complete with maps, details of condition, and recommendations for management. The detailed reports, summarized in this publication, are filed in the Service Center of the Bureau of Land Management at the Denver Federal Center, with copies of each report in the District Office at Lewistown, Montana.

One objective in the writing of this report has been to demonstrate long term trends in soil and vegetative condition. For that reason, extensive use has been made of historical accounts and photographs. The journals of early explorers described the area in sufficient detail to give a good picture of conditions as they were over 160 years ago. The early accounts include those of Lewis and Clark, 1805, the Stevens Expedition of 1853, the Raynolds Exploration of 1859, and Granville Stuart, 1880. These parties were all sponsored by the US Army, with the exception of Granville Stuart. Following the era of explorers came early-day photography, and the land classification reports of the 1920's by the US Geological Survey. Information extracted from the earlier reports is presented in this publication in reasonable detail to give the reader a means of comparing the country in its undeveloped state to present condition.

The field inventory, analysis of data and writing of this report were directed by Supervisory Range Conservationist Richard D. Burr, assisted by Raymond C. Sherfey. The manuscript layout and preparation were the responsibility of secretary Alice J. Boggess. The maps were prepared by draftsman John L. Kovacs. Editing and technical assistance were provided by Eugene L. Schmidt, Chief, Office of River Basin Studies. Valuable advice and assistance were rendered by the Bureau of Land Management District Office at Lewistown, Montana.

SUMMARY

The Musselshell River Drainage Basin, approximately square in shape, is located at the center of Montana. The Judith River and Arrow Creek watersheds, geographically associated with the Musselshell but smaller in size and directly tributary to the Missouri, are discussed as part of the same drainage system.

The Musselshell Subbasin is bordered on the south by the drainage divide of the Yellowstone River, and on the north by the mainstem of the Missouri River, including Fort Peck Reservoir. The eastern boundary is marked by the Musselshell River itself, and the western limit consists of drainage divides along summits of the Highwood, Belt, Castle and Crazy Mountain ranges.

The subbasin measures 145 miles from east to west and from north to south at its extremes; it has an area of 17,530 square miles or 11,219,000 acres, which include all or parts of eleven counties. The Bureau of Land Management administers 890,000 acres; the US Forest Service administers 645,000 acres as part of the Lewis and Clark National Forest. Private and state holdings comprise the remaining 9,684,000 acres. The Bureau of Land Management administers lands throughout the subbasin, but most of the acreage is concentrated along the northeast and east borders, near Fort Peck Reservoir and the Musselshell River.

The subbasin has rolling plains to the south and east, badlands along the Missouri River on the north, and steep-walled canyons and mountains peaks in the west and central portions. Elevations vary from 2,200 feet at the mouth of the Musselshell River, to more than 9,000 feet at the headwaters of the river in the Castle Mountains.

The Musselshell has a river distance of 292 miles, first flowing due east from the Castle Mountain Range, then turning due north to the Missouri River confluence. The annual discharge is 172,000 acre feet. The Judith River extends 124 miles northward from the Belt Mountains to its Missouri River confluence; it has an average annual discharge of 38,000 acre feet. Farmers divert enough water to irrigate 95,000 acres of cropland.

Lewistown, population 7,400, is the center of community services and economic activities. Other important towns are Roundup, with 2800 people, and Harlowton with 1700. Irrigated farming and livestock ranching are the economic backbone of the area; industry and tourism are also significant economic factors.

Most of the public domain is grazed by livestock, which find good forage in the high quality perennial grasses. A comparison between present day vegetation and that growing in the subbasin 160 years ago shows only moderate change. Based on the ecological inventory method, 24 percent of the public domain is currently rated as having "Excellent"

vegetative cover, which is a condition of near-climax vegetation; 60 percent is rated as "Good", and 15 percent as "Fair". Only 1 percent of the public lands were found to be in "Poor" vegetative condition.

Commercial timber grows in the Highwood, Little Belt, Castle and Crazy Mountains in the western part of the subbasin, on the Bull Mountains in the southeast, and in the Moccasin, Judith and Snowy Mountains in the central section. Public domain produces little saw timber, but posts and poles are cut to build fences and corrals. Photographic comparisons show that the number of conifers, especially pines, have increased over the years, invading new sites which previously supported grassland.

Seventy-two percent of the public domain has a land capability of Class VII. Class VII lands are best suited to grazing, but they must be carefully managed to avoid deterioration resulting from overuse on the adverse topography and the shallow or unstable soils. Nineteen percent of the subbasin is in soil Class VI, with relatively good soils and topography; these require only good grazing or timber management practices for continued productive use. Class VIII lands make up 8 percent of the public domain. Such lands are valuable for watershed management and wildlife habitat, but they are too fragile to tolerate use of any greater intensity. The remaining 1 percent of the subbasin is Class V, which designates limited use because of flooding, excessive rockiness, etc.

Accelerated water erosion on the public domain was found to be "none to slight" on 79 percent of the area, "slight to moderate" on 20 percent, and "moderate to severe" on the remaining 1 percent. Wind erosion in the subbasin is negligible. Ninety-nine percent of the area is classified as being in the category "none to slight", and only 1 percent is rated "slight to moderate". Photographic comparison of present conditions with those of sixty or more years ago shows an on-balance stability or improvement in soil erosion conditions.

Two general land patterns occur in the public domain of the Musselshell subbasin. There are areas of concentration to the northeast and east, Fergus, Petroleum and Musselshell counties, plus scattered, isolated tracts throughout the subbasin. The public lands total 890,000 acres. Of that amount, 513,000 acres have never been conveyed out of Federal control since their acquisition in the Louisiana Purchase. The Bureau of Land Management also administers 24,000 acres of withdrawn land. There are another 85,000 acres of public land withdrawn and under administration of other agencies. There are 353,000 acres of Land Utilization project lands, in reasonably compact form, located principally in Fergus, Musselshell and Petroleum counties. These marginal farmlands, once privately owned, were purchased during the 1930's under the Bankhead-Jones Farm Tenancy Act, and have since been managed by either the Department of Agriculture, or more recently, the Department of The Interior. Laws governing use and disposition of the Land Utilization tracts differ from those applicable to the other public lands.

The isolated tracts consist of 659 separate scattered parcels. They average less than 100 acres in size and none exceeds 1,520 acres, the upper limit set by law in the definition of an "isolated tract". Two hundred fifty nine of the tracts, totaling 30,500 acres are best suited to retention and continued management in public ownership. Four hundred tracts containing 30,100 acres are characterized by values which make them better suited to private management.

The Musselshell subbasin is within one of the nation's surplus recreational areas, with abundant potential for increased recreational use. Twenty-eight thousand seven hundred of the 30,500 acres in the isolated tract retention category have specific recreational and fish and wildlife values. The public lands are also a primary source of "open space" for use by expanding populations.

Land tenure recommendations are not made for the 353,000 acres of Bankhead-Jones land; the Act under which they were acquired segregates them from provisions of the public land laws, except for exchange, by which transfers can be authorized.

In the interest of efficiency, the 513,000 acres included in areas of a concentrated public land pattern were inventoried by an Area Classification method that includes intermingled lands of other ownership. These lands were reported separately to the Lewistown District Office, and their legal descriptions are not found in Appendix A with the isolated tracts.

Classification recommendations made in this report do not constitute an administrative determination for land retention or disposal. An authorized official of the Bureau of Land Management must review and approve all land use proposals before action is taken on applications and before any change in land status occurs.

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GENERAL DESCRIPTION

Location, Size and Natural Features

The Musselshell River Subbasin and adjacent Judith River drainage form a nearly square area of rolling hills and steep mountains in central Montana. Figure 3. The area is bordered on the south by the Yellowstone River divide and on the west by the drainage divides of the Highwoods, Belt, Castle, and Crazy Mountains. The Missouri River forms the northern border, and the Musselshell River marks the eastern limit. The subbasin measures 145 miles square at its extremes and has an area of approximately 17,530 square miles or 11,219,000 acres.

The Bureau of Land Management administers 890,000 acres in the subbasin; the U.S. Forest Service administers 645,000 acres as part of the Lewis and Clark National Forest. The remainder of the land is State and privately owned.

The Musselshell valley extends from the Castle Mountains on the southwest, eastward through Meagher, Wheatland, Sweet Grass, Golden Valley, Stillwater and Musselshell counties. The valley then turns northward through Petroleum county to Ft. Peck Reservoir. The Judith River valley extends northward from the Belt Mountains through Judith Basin and Fergus counties. The northern slopes of Chouteau, Fergus, and Petroleum counties drain directly into the Missouri River through individual tributaries. Figure 4.

The Musselshell River heads at 9,200 feet above sea level and drops to 2,200 feet as it flows 292 miles to its junction with the Missouri at Fort Peck Reservoir. Upstream, the average annual flow is 8,800 acre feet. Downstream, near Mosby, the average annual flow is 172,000 acre feet.

The Judith River heads at 8,700 feet above sea level and drops to 2,425 feet at its junction with the Missouri. It flows 124 miles and has an annual discharge of about 38,000 acre feet. The Belt and Castle Mountains on the subbasin's western border are the primary source of water with winter snowpack supplying most of the flow.

With the exception of the Snowy and Judith Mountains in the central area, the rough, timbered mountainous land lies along the western border. Major streams and tributaries are usually paralleled by narrow flood plains which merge into rough, broken, eroded lands.

Mountainous and rough terrain are timbered with ponderosa pine, Douglas-fir and limber pine. Most of the forested lands lie within the Lewis and Clark National Forest on the west but a large area of timbered land in the Judith Mountains is administered by the Bureau of Land Management.

Most of the subbasin has a rough broken surface and is devoted to livestock grazing and wildlife habitat. Farming occupies a relatively small part of the subbasin. About 95,000 acres of cropland are irrigated and planted principally to alfalfa hay. On the dryland, satisfactory crops of hay and small grains are raised, especially wheat.

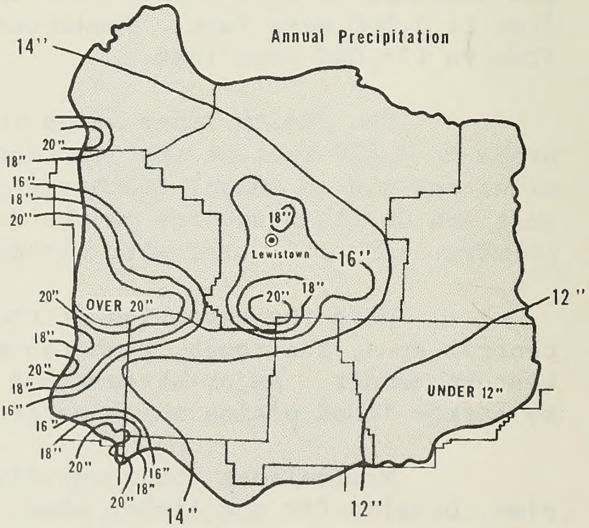
The subbasin's population, transportation and economic activity are focused at Lewistown (7,408 population) and along the Musselshell River at Roundup (2,842) and Harlowton (1,734). Irrigated farming, livestock ranching, industry, and tourism are responsible for their growth.

U.S. Highway 12, the major east-west highway, parallels the Musselshell River. Major north-south highways are U.S. Highway 87 from Lewistown to Great Falls and U.S. Highway 191 from Lewistown to Malta. Elsewhere numerous improved and unimproved roads interlace the subbasin. The U.S. Forest Service maintains roads open to the public in the Lewis and Clark National Forest, plus a network of trails.

The Chicago, Milwaukee, St. Paul and Pacific Railroad parallels the Musselshell River, with a branch line from Harlowton through Lewistown and northward out of the subbasin. The Burlington Lines have a branch track to Winnett. Scheduled airline service is available from Lewistown; rail, bus lines and truck-line freight service is available at most of the communities. Public transportation from localities not on the railroad or U.S. Highways is limited to auto-freight lines and mail carriers.

Climate

The major climatic zones of the Musselshell subbasin are readily apparent in photographs, or to the eye of the interested observer. Each climatic zone, with its own variables of temperature, rainfall, length of day, wind pattern, and other features, produces a characteristic, adapted, native vegetation. The climate is also a major factor in determining the agriculture of the region, limiting as it does, the species of cultivated crops that can be produced.



The cool, semiarid climate of 85 percent of the subbasin is well suited to the

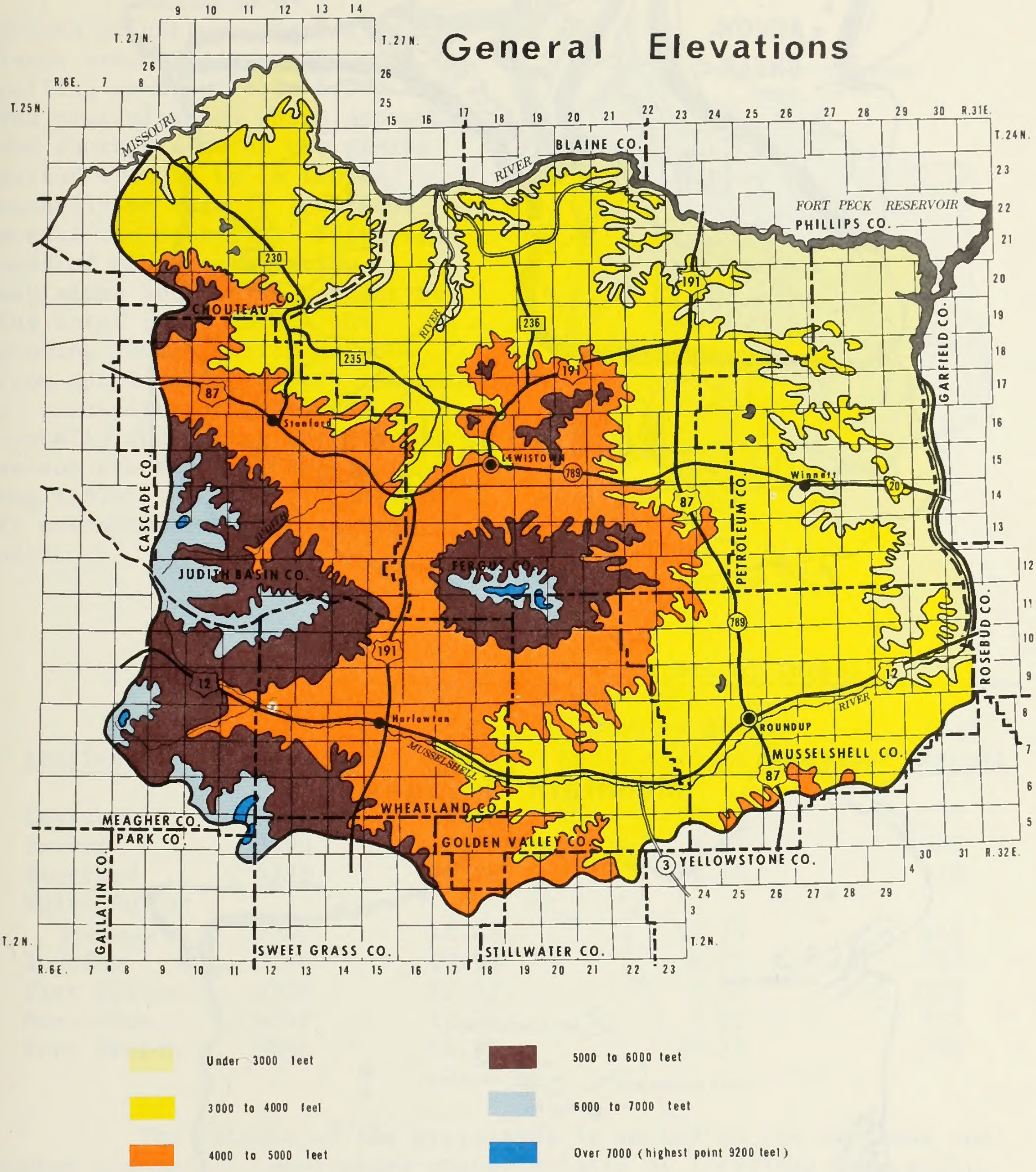

General Elevations
MISSOURI
RIVER
BLAINE CO.
FORT PECK RESERVOIR
PHILLIPS CO.
GARFIELD CO.
ROSEBUD CO.
CHOUTEAU CO.
CASCADE CO.
JUDITH BASIN CO.
FERGUS CO.
PETROLEUM CO.
MUSSELSHELL CO.
WHEATLAND CO.
GOLDEN VALLEY CO.
YELLOWSTONE CO.
MEAGHER CO.
PARK CO.
GALLATIN CO.
SWEET GRASS CO.
STILLWATER CO.
Stanford
LEWISTOWN
Winnett
Harlowton
ROUNDUP
MUSSELSHELL
RIVER
230
235
236
191
87
789
200
12
3
T.27N.
T.25N.
T.24N.
T.2N.
R.6E.
R.31E.
R.32E.
Under 3000 feet
3000 to 4000 feet
4000 to 5000 feet
5000 to 6000 feet
6000 to 7000 feet
Over 7000 (highest point 9200 feet)

Figure 4

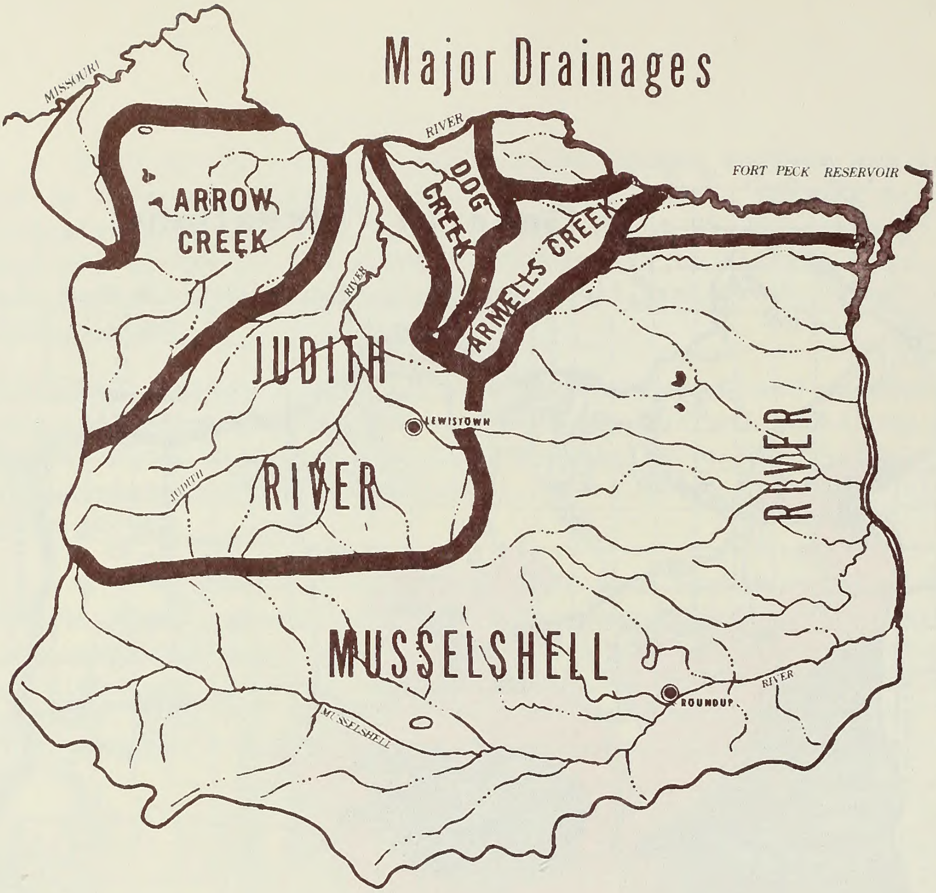


Figure 5

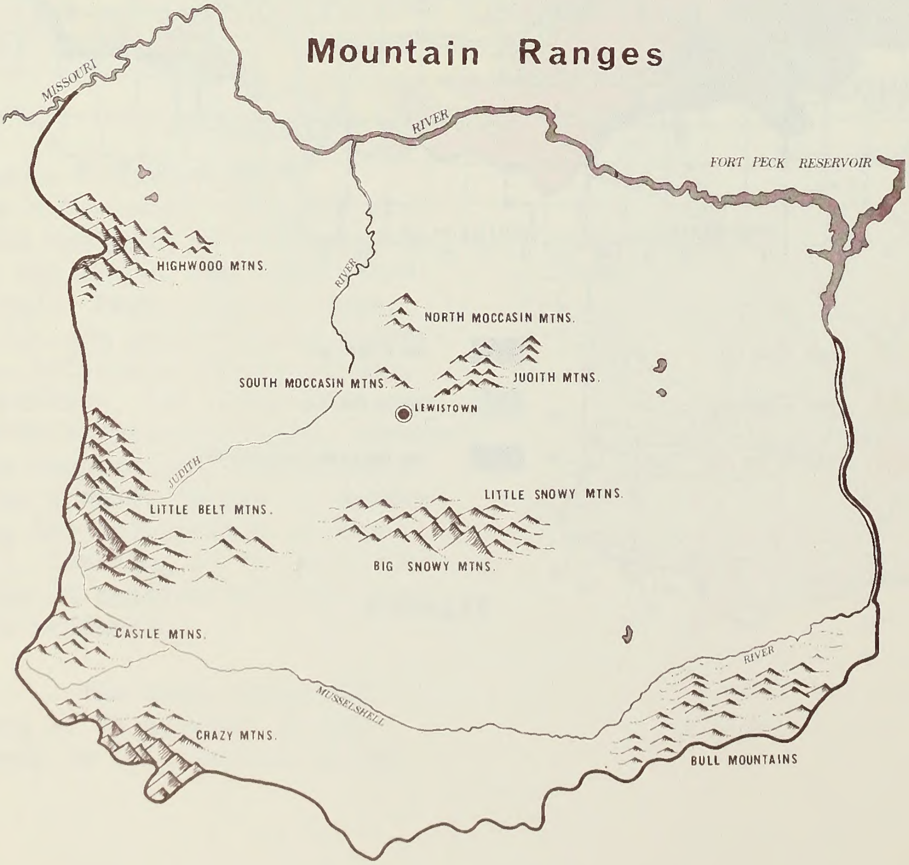


Figure 6

growth of native grasses. Grasslands predominate on the open, rolling country below 5,000 feet. The precipitation which supports the shortgrasses of the plains varies from 11 to 16 inches annually at various locations across the subbasin. Effectiveness of the precipitation is maximized because 75 percent of the total falls during the growing season, which extends from April to September. Amounts of precipitation received annually and during the growing season are shown on the following table; the rainfall pattern is presented on accompanying maps.

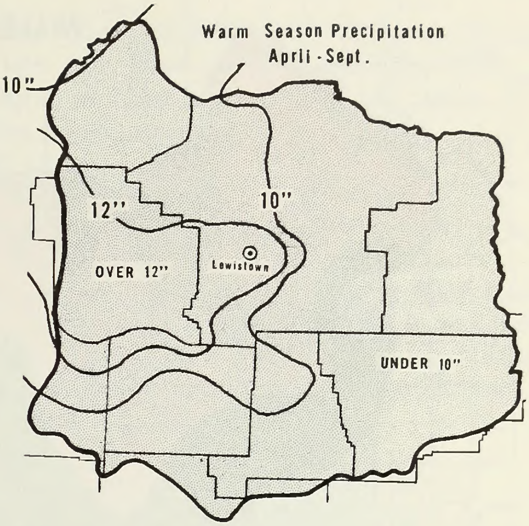


Figure 7

		Precipitation, Inches		
Stations	Elevations	Annual	Growing Season April through September	% of Annual
Lewistown	3963	16.52	12.02	73%
Barber	3990	12.53	9.68	77%
Stanford	4285	14.96	11.19	75%
White Sulfur Springs	5000	18.46	11.19	61%
Roundup	3186	10.93	8.22	75%
Flat Willow	3200	12.57	9.53	76%
Harlowton	4245	12.74	9.81	77%
Fort Benton	5886	14.57	10.13	70%

The climate of the grasslands is marked by the extremes and sudden changes in temperature characteristic of locations deep within a continental interior. Mean annual temperatures vary but little between weather stations. At lower elevations the temperatures tend to cluster at 45 to 47 degrees F; from 3,000 to 4,000 feet they average 44 degrees F., and near the 5,000 foot mark the mean annual temperature is 42 degrees.

The record high temperatures for twelve weather stations are not excessive. They range from 102°F. at Harlowton and Stanford to 108°F. at Winifred and Flat Willow. Half of the 12 stations had their record highs in the temperature range between 102°F. to 104°F.. Record low temperatures are definitely cold, the lowest of -54°F. was recorded

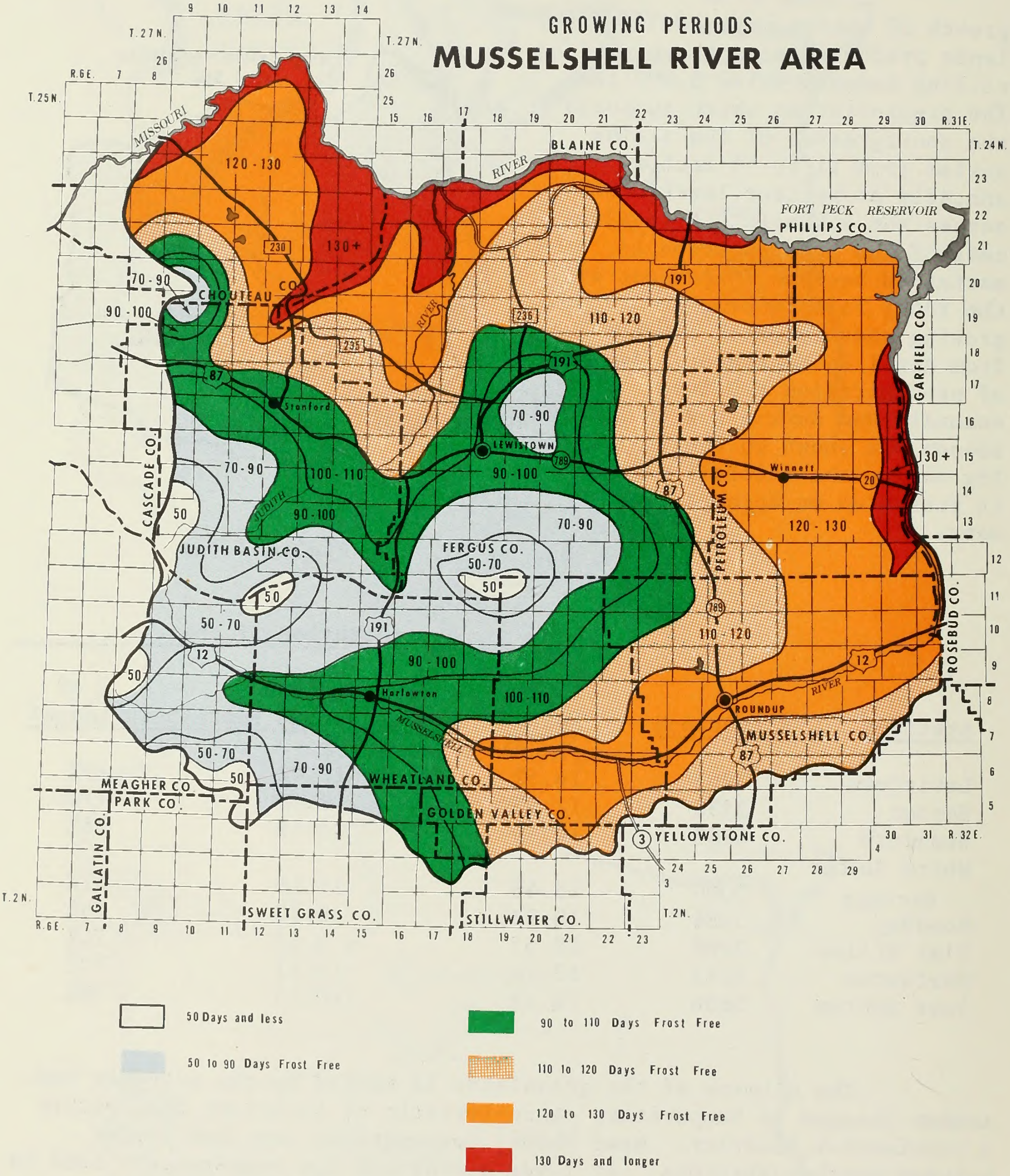

GROWING PERIODS
MUSSELSHELL RIVER AREA
BLAINE CO.
PHILLIPS CO.
FORT PECK RESERVOIR
GARFIELD CO.
ROSEBUD CO.
PETROLEUM CO.
MUSSELSHELL CO.
YELLOWSTONE CO.
STILLWATER CO.
SWEET GRASS CO.
GOLDEN VALLEY CO.
WHEATLAND CO.
MEAGHER CO.
PARK CO.
GALLATIN CO.
CASCADE CO.
JUDITH BASIN CO.
FERGUS CO.
CHOUTEAU CO.
MISSOURI RIVER
JUDITH RIVER
MUSSELSHELL RIVER
Stanford
LEWISTOWN
Winnett
Harlowton
ROUNDUP
120 - 130
130 +
110 - 120
100 - 110
90 - 100
70 - 90
50 - 70
50
50 Days and less
50 to 90 Days Frost Free
90 to 110 Days Frost Free
110 to 120 Days Frost Free
120 to 130 Days Frost Free
130 Days and longer

Figure 8

at Harlowton; Barber and Roy have records of -40°F. and the other stations lie between -40°F. and -48°F..

The winds throughout the year blow mainly from the southwest with average velocity of 10 to 14 miles per hour. In November, the wind speed increases to 16 or 17 miles per hour and maintains this average through February; in March the wind speed drops.

Snow has been recorded during every month, for every weather station reporting. The average depth of snow on the plains is least in the eastern and southern sections of the Musselshell subbasin, where 36 inches accumulates annually; westward, the average amounts increase to 61 inches at Lewistown. The only snowfall record available for the mountains is at Kings Hill, at 7,300 feet elevation on the western margin of the subbasin, where the annual accumulation is 23 feet.

Winter is habitually a time of stress in the Musselshell subbasin. In the past, the cattle industry has suffered periodic severe losses, most notable of which occurred during the winter of 1886-1887. Each winter brings danger to livestock, wildlife, and humans. In compensation, the snow provides certain benefits which may not be fully recognized. Among them is the snow blanket that protects sprouted winter wheat which depends for survival on maintaining a viable root system over the winter. The snow pack is also the chief means by which the permanent streams are maintained, carrying their water for irrigation, domestic, recreation and other uses. Winter recreation is of growing economic importance; skiing is popular and one commercial lift operates near Kings Hill.

Visible results of the cool, subhumid climate of the higher elevations of the Belt, Highwood, Snowy, Mocassin and Judith Mountains are the timber covered slopes extending upward from an elevation of 5,000 feet to approximately 8,000 feet above sea level. Elevations above 8,000 feet comprising less than one percent of the subbasin, have a severe, cold, humid, alpine climate which supports little or no timber; instead, the vegetative aspect is that of a tundra.

Geology

The Musselshell River area is characterized by terrace lands, local badlands and isolated mountains. Precambrian rocks exceeding 600 million years in age are exposed here.

The most prominent geological feature of the area is the large east-west trending anticlinal uplift projecting eastward from the Rocky Mountains into the Montana plains. This anticline includes the Little Belt and Big Snowy Mountains. The isolated mountains in the Musselshell River area are of four different types: (1) vertical

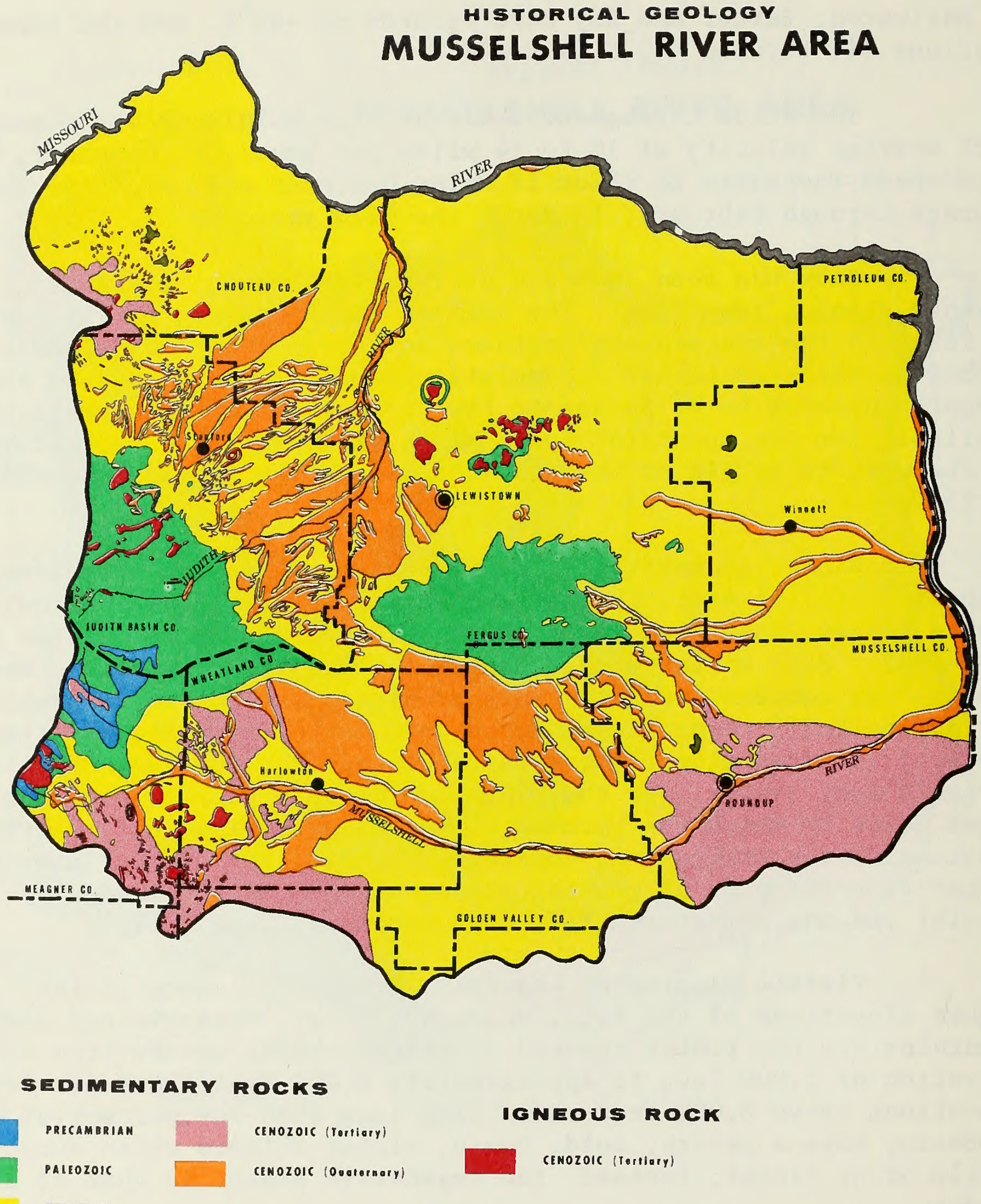

HISTORICAL GEOLOGY
MUSSELSHELL RIVER AREA
MISSOURI
RIVER
CHOUTEAU CO.
PETROLEUM CO.
RIVER
Stanford
LEWISTOWN
Winnett
JUDITH
JUDITH BASIN CO.
WHEATLAND CO.
FERGUS CO.
MUSSELSHELL CO.
Harlowton
MUSSELSHELL
RIVER
ROUNDUP
MEAGHER CO.
GOLDEN VALLEY CO.
SEDIMENTARY ROCKS
PRECAMBRIAN
PALEOZOIC
MESOZOIC
CENOZOIC (Tertiary)
CENOZOIC (Quaternary)
IGNEOUS ROCK
CENOZOIC (Tertiary)

Figure 9

uplift, (2) intrusion of igneous rock, (3) piles of lava, and (4) erosion remnants of elevated areas.

Mountains formed by vertical uplift are the Big Snowy and Little Belts. The uplift was probably caused by upward movement of basal rock at great depth.

Intrusions of igneous rock produced the Judith, Moccasin and Crazy mountains. The molten material squeezed itself between layers of strata and arched the younger sediments into domes. In the central part of these mountains an intrusive core of igneous rock is now exposed due to action by erosion. Gold and silver mineralization resulting from intrusive action is present in the Judith and Moccasin mountains.

The Highwood Mountains are an example of mountains consisting of piles of lava. They were formed by liquid lava breaking through sedimentary rock and spreading itself over the land surface. The lava has resisted erosion and survives as a high area.

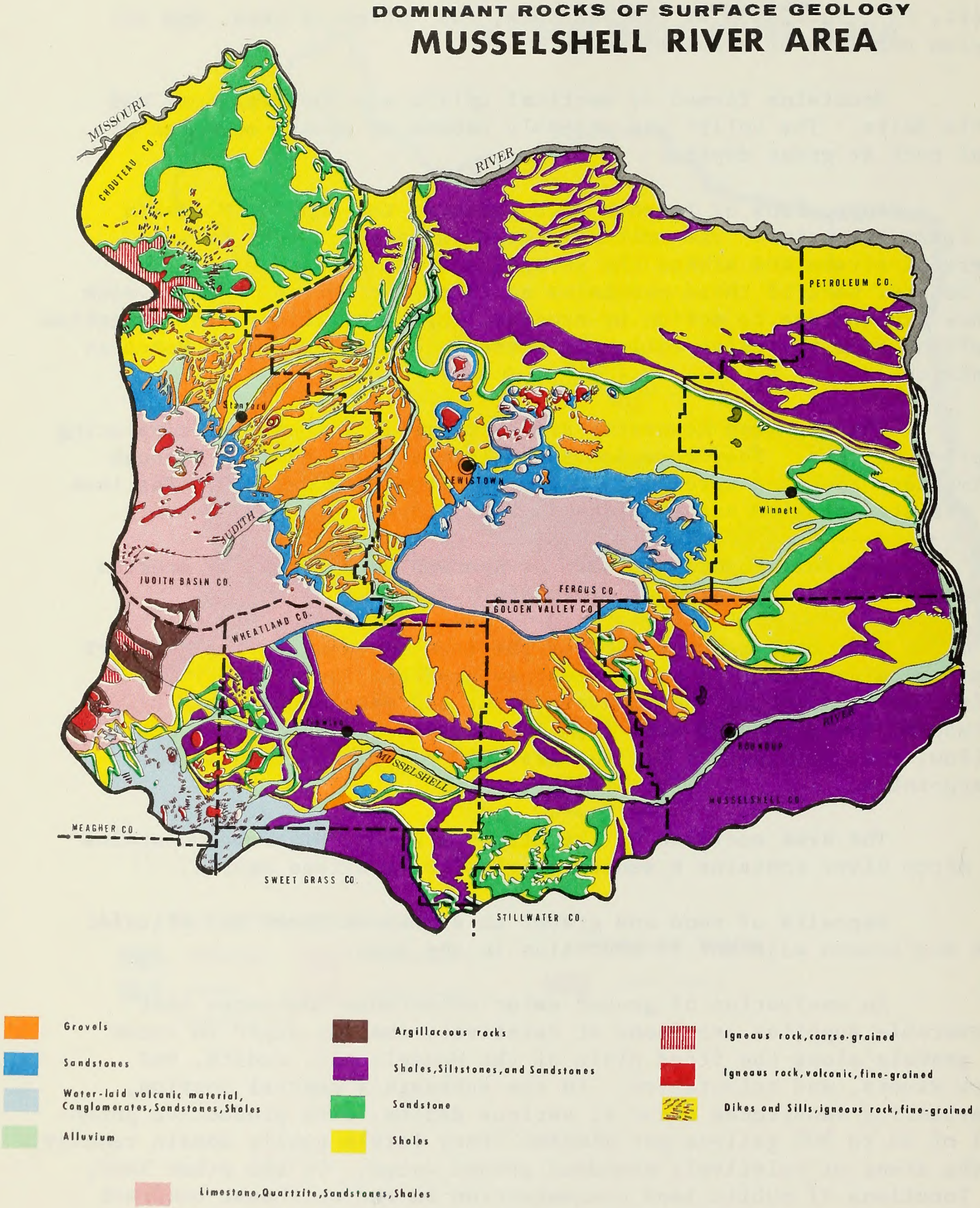
The Bull Mountains south of Roundup were formed by erosion cutting into a high region of sedimentary rocks.

The north-central part of the area adjacent to the Missouri River contains a portion of the Bearpaw Mountain fault zone. The faults lie parallel to the mountain front and were caused by a horizontal force pushing away from the mountains. The faults are shallow, and drilling for oil and gas in the area has been locally disappointing.

The area enclosed by the Missouri River, Highwood Mountains and Arrow River contains a veneer of glacier-deposited debris.

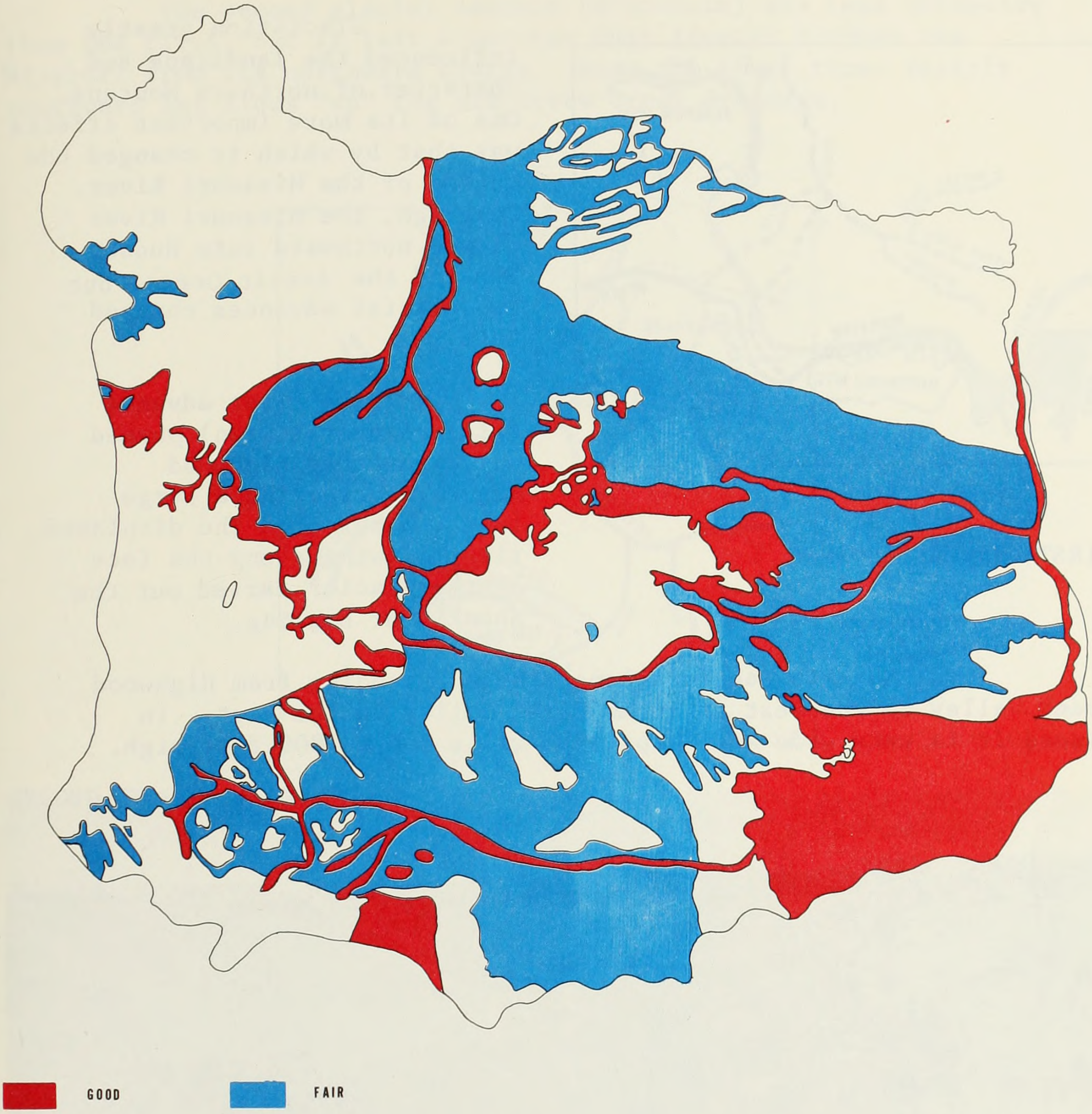
Deposits of sand and gravel in stream terraces and alluvial fans are common adjacent to mountains in the area.

An evaluation of ground water occurrence indicates that recoverable supplies are found at relatively shallow depth in sands and gravels along the flood plain of the Musselshell, Judith, and Arrow rivers, and tributaries. In the subbasin's central portion, waterbearing sandstones occur at various depths, with productive potential of 50 to 500 gallons per minute. Very little public domain remains in the areas of relatively abundant ground water. On the other hand, the locations of public land concentration in the northeast quadrant have little prospect of ground water recovery, so the chances for irrigation development of any of these lands is considered poor.



DOMINANT ROCKS OF SURFACE GEOLOGY
MUSSELSHELL RIVER AREA
MISSOURI
RIVER
CHOUTEAU CO.
PETROLEUM CO.
Stanford
LEWISTOWN
Winnett
JUDITH
JUDITH BASIN CO.
FERGUS CO.
GOLDEN VALLEY CO.
WHEATLAND CO.
ROUNDUP
RIVER
MUSSELSHELL
MUSSELSHELL CO.
MEAGHER CO.
SWEET GRASS CO.
STILLWATER CO.
Gravels
Sandstones
Water-laid volcanic material, Conglomerates, Sandstones, Shales
Alluvium
Limestone, Quartzite, Sandstones, Shales
Argillaceous rocks
Shales, Siltstones, and Sandstones
Sandstone
Shales
Igneous rock, coarse-grained
Igneous rock, volcanic, fine-grained
Dikes and Sills, igneous rock, fine-grained

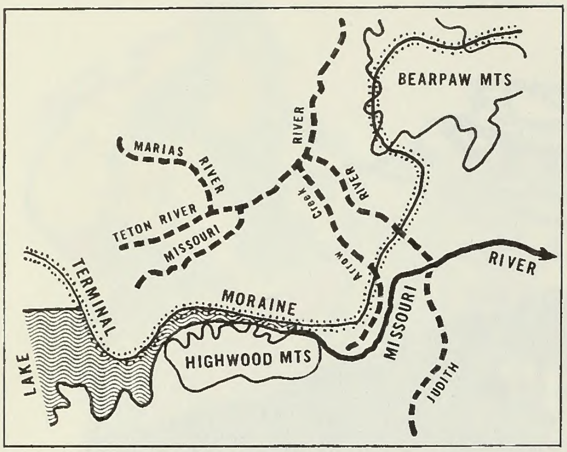
Figure 10



GROUND WATER POTENTIAL

Figure 11

Glaciation



FIRST GLACIAL ADVANCE

Glaciation greatly influenced the landscape and character of northern Montana. One of its more important effects was that by which it changed the course of the Missouri River. Long ago, the Missouri River flowed northward into Hudson Bay and the Arctic Ocean, but two glacial advances changed this.

The first advance (Illinoian or Iowian) pushed up against the Highwood Mountains creating a large lake. Water from the displaced river flowing along the face of the glacier carved out the Shonkin or Big Sag.

The Shonkin Sag is a long trough extending from Highwood Creek Valley on the west to Arrow Creek Valley on the east. In places it is very wide and deep, with walls 500 to 800 feet high.

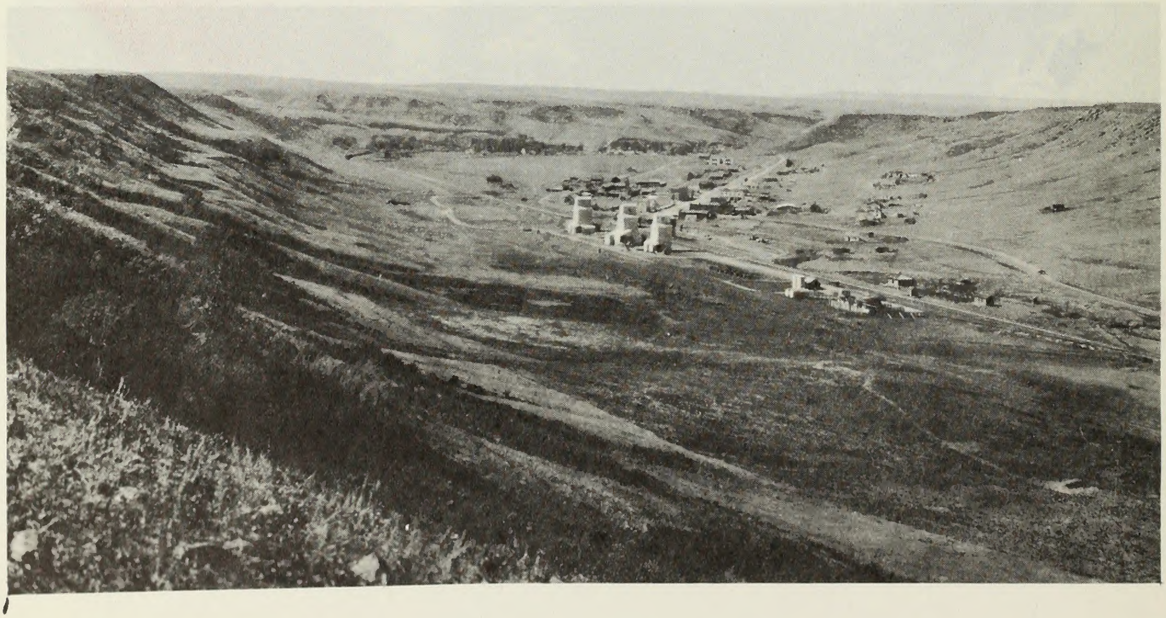
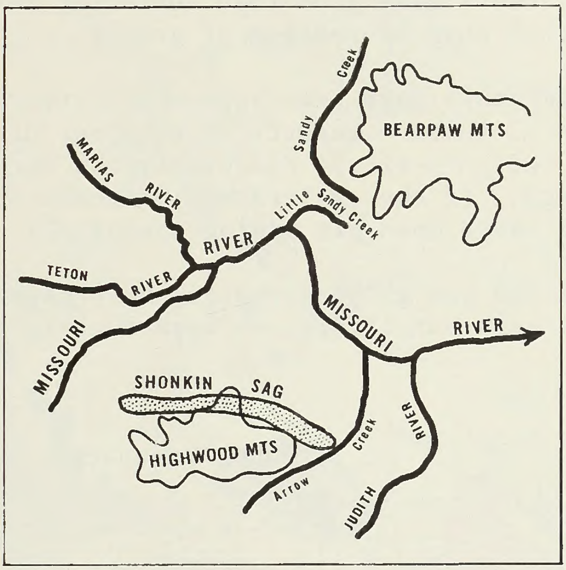


Figure 12 The Shonkin Sag was carved out by the Missouri River. This part, near Highwood, is 200 to 300 feet deep. U. S. Geological Survey photo.

The second glacial advance (Wisconsin) was less extensive than the first, but it left a moraine that forever blocked the Missouri from its northward course. Now, the river turns sharply southward and flows "up" the old Arrow Creek drainage.



SECOND GLACIAL ADVANCE

Mineral Resources

Mineral resources of the Musselshell subbasin include oil and gas, coal, gypsum, clay, bentonite, clinkers, silver and gold, gems, sand and gravel.

Thirteen producing oil fields and three shut-in oil fields are found in the Musselshell area. Continued oil and gas activity can be expected.

Bituminous or sub-bituminous coal underlies much of the subbasin. Excessive overburden over most of the coal, and/or thin beds places the coal in a poor position to compete with thick beds in eastern Montana that can be mined by open pit methods. Six small underground coal mines are in operation, producing 35,000 tons annually.

Exploration work by the Montana Bureau of Mines indicates that an area of strippable coal is located south of Melstone. It is estimated that 20 million tons of the deposit lie within the Musselshell subbasin.

Gypsum bearing formations are present in Fergus and Judith Basin Counties. Gypsum is being mined near Heath in Fergus County by U. S. Gypsum Company.

Building brick is produced in the Lewistown area from locally mined clays.

Bentonite occurs in shale formation in the eastern third of the subbasin. Attempts are being made to develop the deposits but success is questionable.

Clinkers resulting from burned coal beds occur south and east of Roundup. Clinkers make good road surfacing material, and are often used for that purpose instead of gravel.

Several companies have had exploratory programs in the area within the last several years. Reports of a copper discovery in Judith River County and gold-silver discoveries in Fergus County have not been substantiated. If the exploratory programs are successful they could result in large open pit mining operations.

Industrial and gem grade sapphires have historically been mined in the Judith Basin but little has been done in recent years.

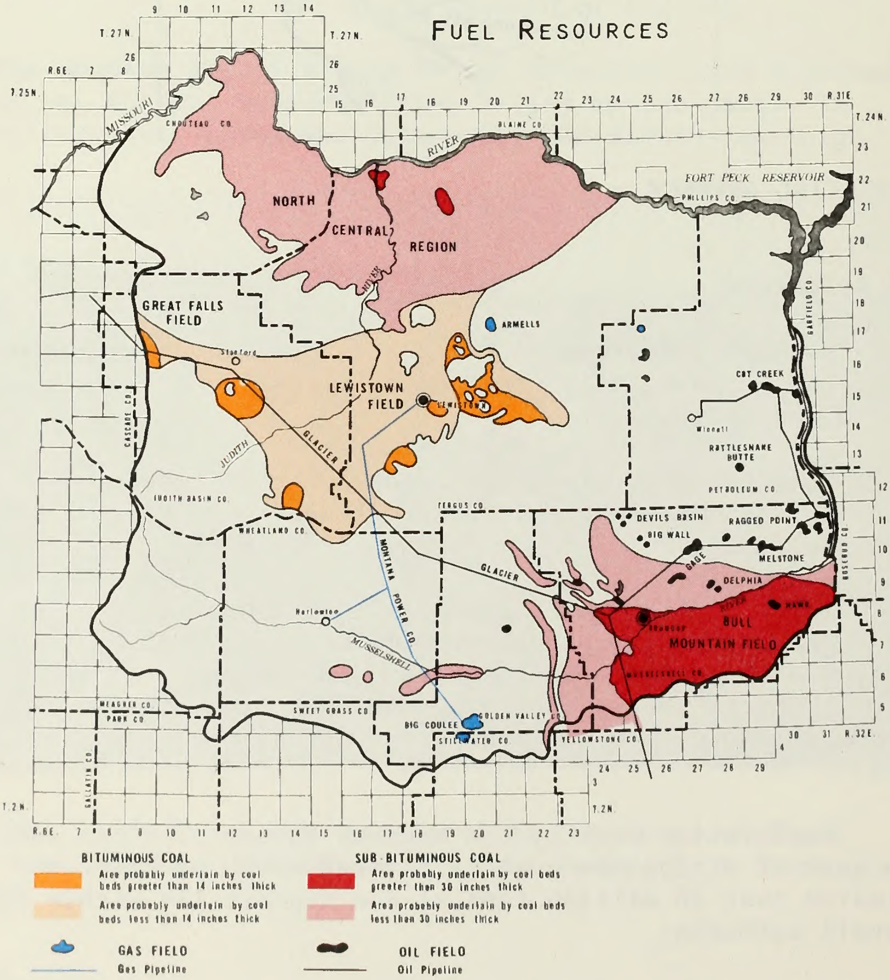


Figure 13

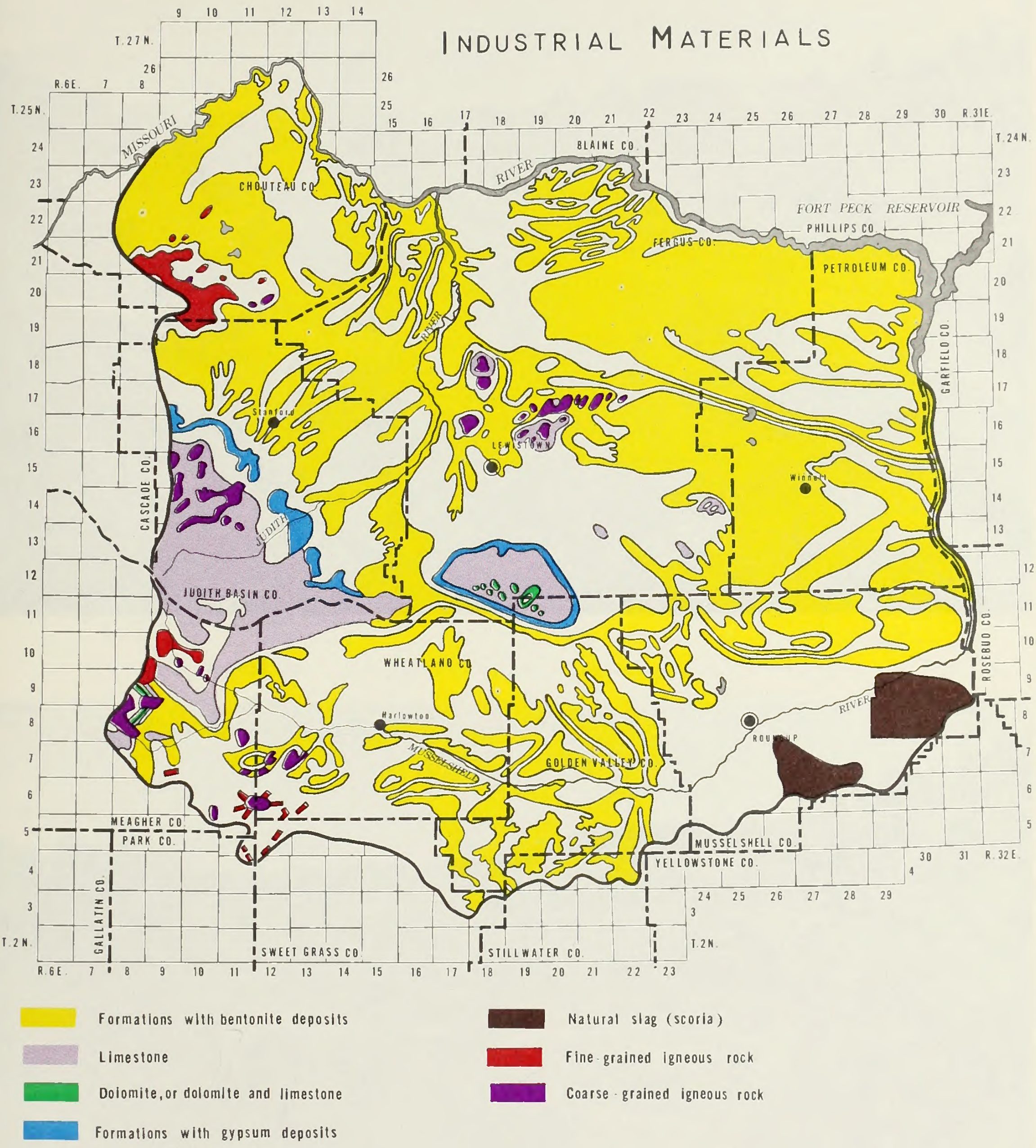
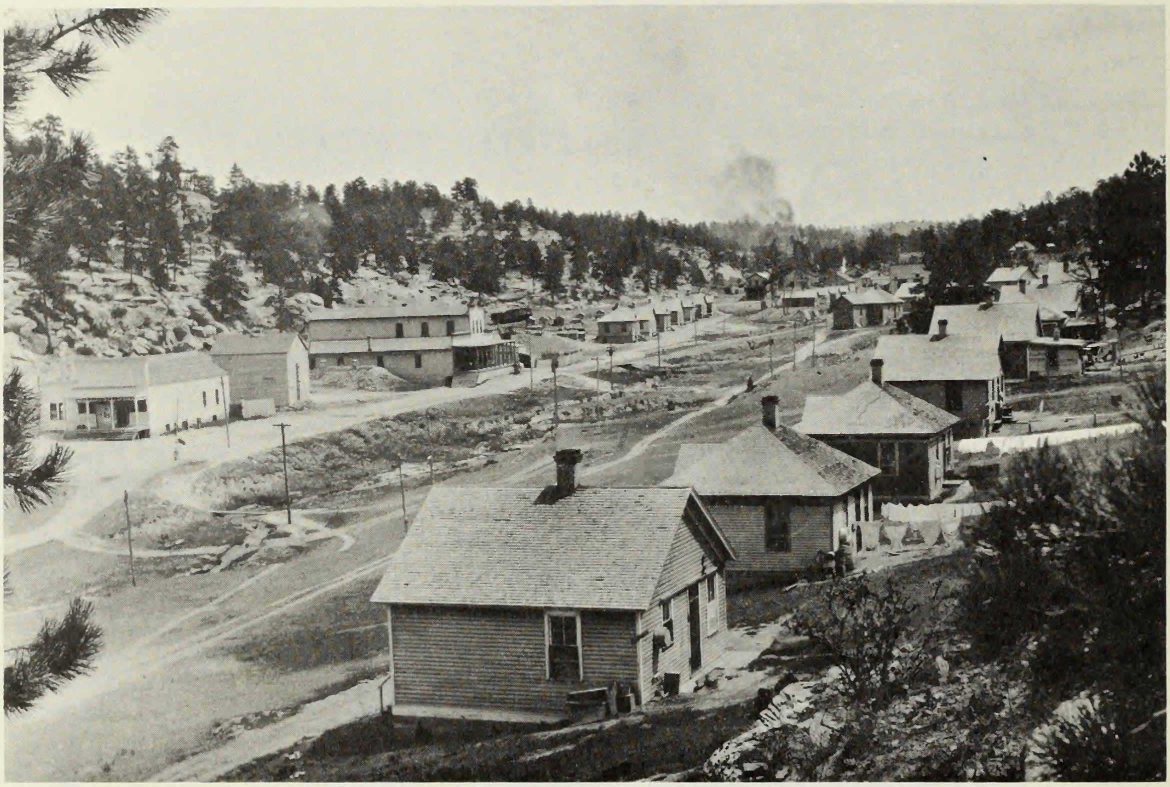
INDUSTRIAL MATERIALS
CHOUTEAU CO.
BLAINE CO.
FERGUS CO.
PHILLIPS CO.
PETROLEUM CO.
GARFIELD CO.
ROSEBUD CO.
CASCADE CO.
JUDITH BASIN CO.
WHEATLAND CO.
GOLDEN VALLEY CO.
MUSSELSHELL CO.
YELLOWSTONE CO.
MEAGHER CO.
PARK CO.
GALLATIN CO.
SWEET GRASS CO.
STILLWATER CO.
MISSOURI
RIVER
FORT PECK RESERVOIR
JUDITH
MUSSELSHELL
Stanford
LEWISTOWN
Winnett
Harlowton
ROUNDUP
T.27N.
T.25N.
T.24N.
T.2N.
R.6E.
R.31E.
R.32E.
Formations with bentonite deposits
Limestone
Dolomite, or dolomite and limestone
Formations with gypsum deposits
Natural slag (scoria)
Fine-grained igneous rock
Coarse-grained igneous rock

Figure 14



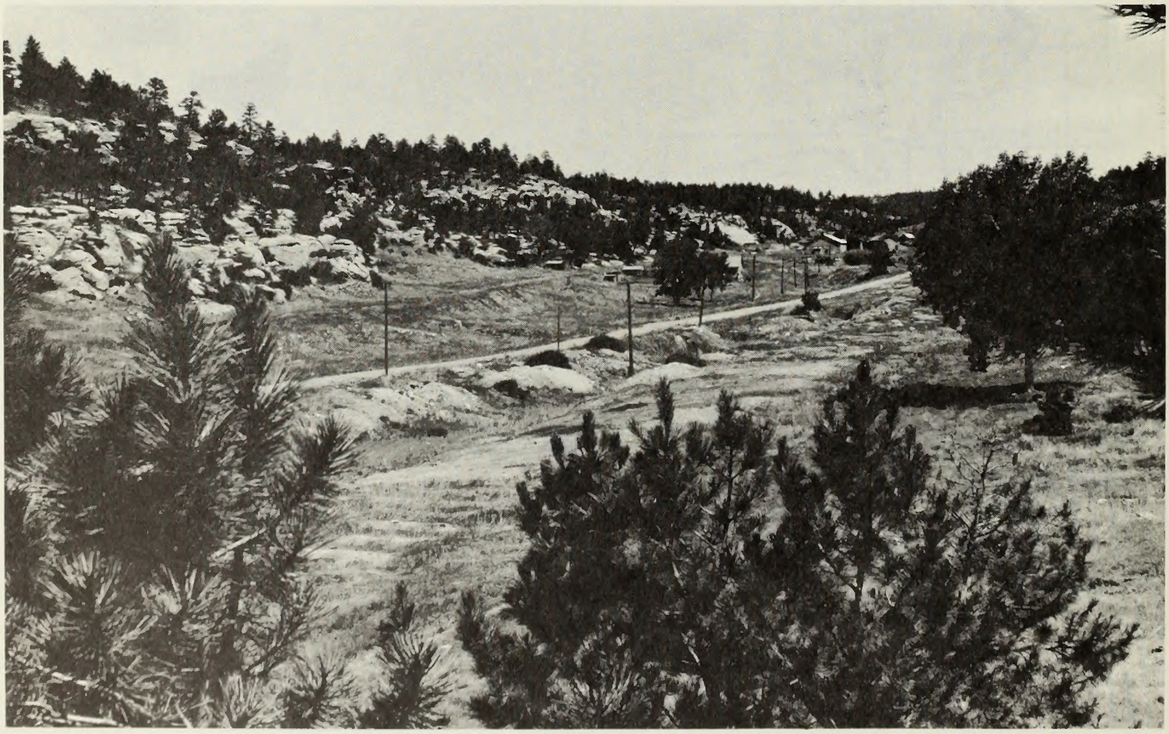


Figure 15. Kline Townsite, Musselshell County. Top photo, Lupton 1913. Bottom photo BLM 1965. When the coal industry collapsed, Kline became a ghost town. The potential is still there, but excessive overburden, thin coal seams, and new legislation makes it impossible for the area to compete with other regions.

Soils

Soils of the public lands generally have undeveloped or immature profiles. They are mostly nonagricultural shallow, rocky soils, well adapted to their present uses of livestock grazing, wildlife habitat and timber production, watershed protection, and recreation.

The soils have identifying characteristics resulting from their formation under one or the other of the two major topographic regions, the "Plains", or the "Mountains". In combination, these regions comprise 96 percent of the subbasin. Soils on the remaining 4 percent of the area cannot be classified according to major topographic regions since they consist of Badlands, Alluvial, and Saline soils.

Development of the plains soils took place under a cool and semi-arid to arid climate. During the winter, soil formation cannot continue because of freezing. It resumes again in the summer, but is often hindered by drought.

Plains Regions - 85% of subbasin

Brown Soils	.... 54%
Chernozem Soils	.... 15%
Chestnut Soils	..... 8%
Grumosol Soils	... 5%
Sierozem Soils	.. 3%

Approximately 60 to 70 percent of the public domain has Brown soils. Most of the Brown soil area is in native vegetation of shortgrasses, bunchgrasses and shrubs. Some of the privately owned lands are in irrigated and dryland cultivation. Many farms in the Brown soil regions were purchased by the federal government under the Bankhead-Jones Act. The fields were seeded to crested wheatgrass to provide forage and protect the watershed.

The highly productive Chernozem soils are usually under cultivation. In some areas, they are in native vegetation because of high elevation and short growing season.

Chestnut soils developed under mixed tall grasses. They are deep and, for the most part, in irrigated or dryland cultivation.

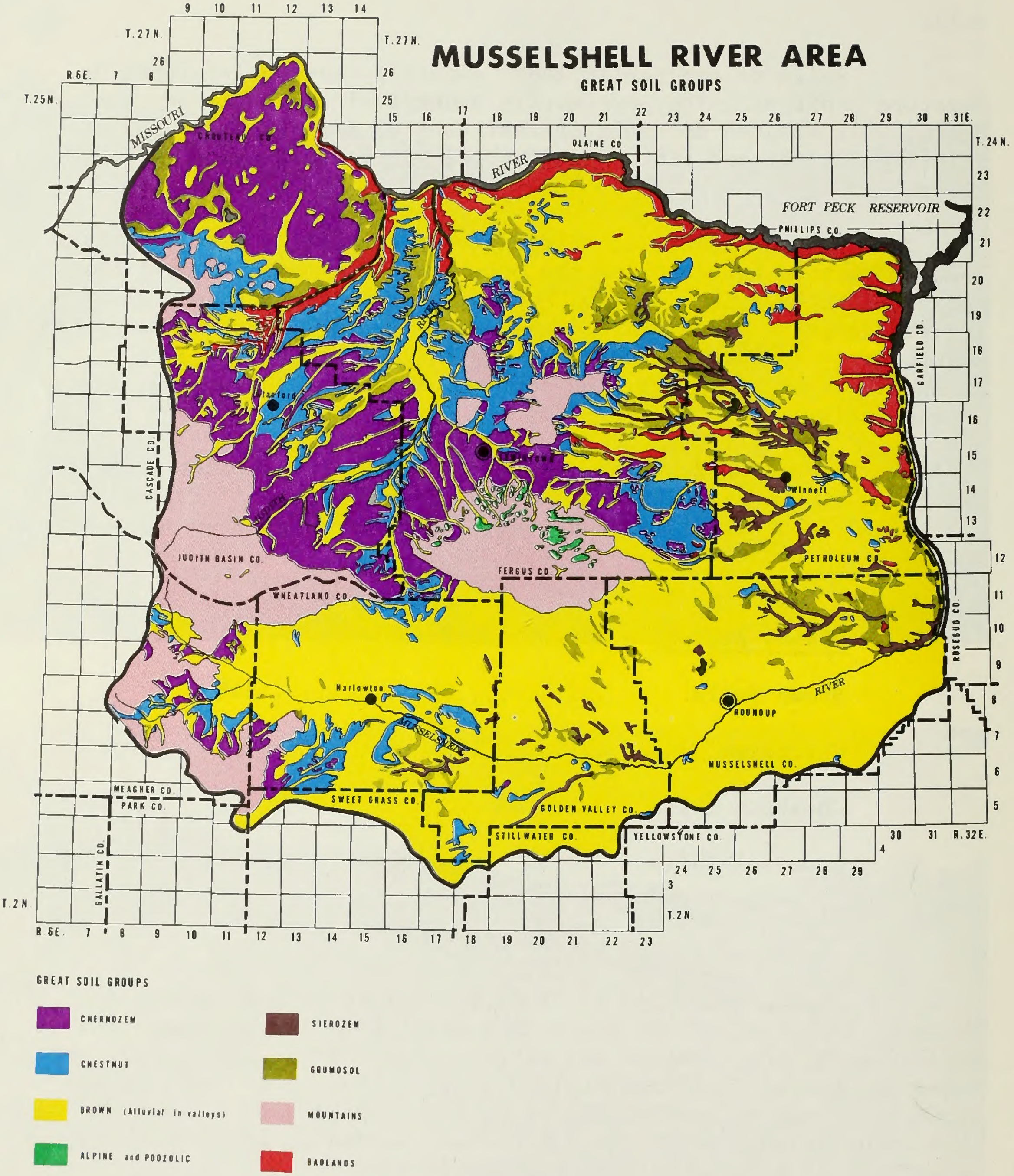

MUSSELSHELL RIVER AREA
GREAT SOIL GROUPS
MISSOURI
RIVER
CHOUTEAU CO.
BLAINE CO.
FORT PECK RESERVOIR
PHILLIPS CO.
GARFIELD CO.
CASCADE CO.
JUDITH BASIN CO.
FERGUS CO.
PETROLEUM CO.
WHEATLAND CO.
ROSEBUD CO.
MEAGHER CO.
PARK CO.
GALLATIN CO.
SWEET GRASS CO.
GOLDEN VALLEY CO.
STILLWATER CO.
YELLOWSTONE CO.
MUSSELSHELL CO.
JUDITH
Stanford
Lewistown
Winnett
Harlowton
ROUNDUP
MUSSELSHELL
RIVER
T.27N.
T.25N.
T.24N.
T.2N.
R.6E.
R.31E.
R.32E.
GREAT SOIL GROUPS
CHERNOZEM
CHESTNUT
BROWN (Alluvial in valleys)
ALPINE and PODZOLIC
SIEROZEM
GRUMOSOL
MOUNTAINS
BADLANDS

Figure 16

Only scattered tracts of public domain occur in areas of Chernozem and Chestnut soils.

In the more arid portions of the subbasin, Sierozem and Grumosol soils are found. Grumosol soils have a high clay content making them plastic and subject to shrinking and swelling. They are nearly impermeable, and characterized by hardpans and slick spots. The horizons of Sierozem soils are faintly marked, as the climate is arid - more arid than regions of Grumosol soils.

Mountainous Regions - 11% of subbasin

Mountains	.... 10%
Alpine and Podzolic Soils	.. 1%

Mountainous regions make up 11 percent of the subbasin and are generally valued for watershed, wildlife and recreation. The mountainous regions are rocky, often barren, steep and broken and with very shallow soils. Most of the area has conifer timber and is managed by the U. S. Forest Service. At higher elevations, dark-colored Alpine soils developed under open stands of timber or in wet meadows. The vegetation is turf-like; frost heaving and soil creep are common. At lower elevations and under conifer forests, Podzolic soils developed. Only a few tracts of public domain lie on Podzolic soils and none are found on the Alpine soils. Soils of the mountainous regions are very valuable for their role in watershed protection at the source of the subbasin's streams.

Undifferentiated Soils - 4% of subbasin

Badlands	.... 3%
Alluvial and Saline Soils	.. 1%

Badlands are located along the Judith and Musselshell Rivers. They are characterized by very steep, barren slopes. Weathered soil material is removed by geological erosion as rapidly as it forms. There are two types of badlands. Shaley badlands are formed from gullied clay, and they have shale-capped hills, ridges and buttes. Sandstone badlands have sandstone-capped ridges with barren cliffs and steep escarpments. The softer material under the sandstone erodes away forming shelves and mushroom shapes. Badland areas are almost entirely public domain and are best suited for watershed, wildlife and recreation.

A limited amount of soil was developed from alluvium in the valleys. These are level, deep soils, poorly developed but because of their location, depth, and usually favorable water relationships, they can be highly productive cropland. Poorly drained areas are in grass, brush and trees, and are used for pasture.

Saline soils are also uncommon. These soils are often structureless. They are susceptible to erosion because of scarce plant cover, and they lack granular soil structure because of the adverse action of sodium ions. More important, the clays of the saline soils often have a sandwich-like molecular structure that swells and shrinks with soil moisture. The pronounced cracks that form lead to a specialized form of erosion called "piping", Appendix B. Productivity of the saline soils varies with their location. Low-lying wet meadows are quite productive; other areas are almost barren.

Sedimentation

The breaks of the Missouri and Musselshell Rivers contribute sediment at the highest rates within the subbasin. Nearly all of the breaks are public domain located within the Fort Peck Game Range.

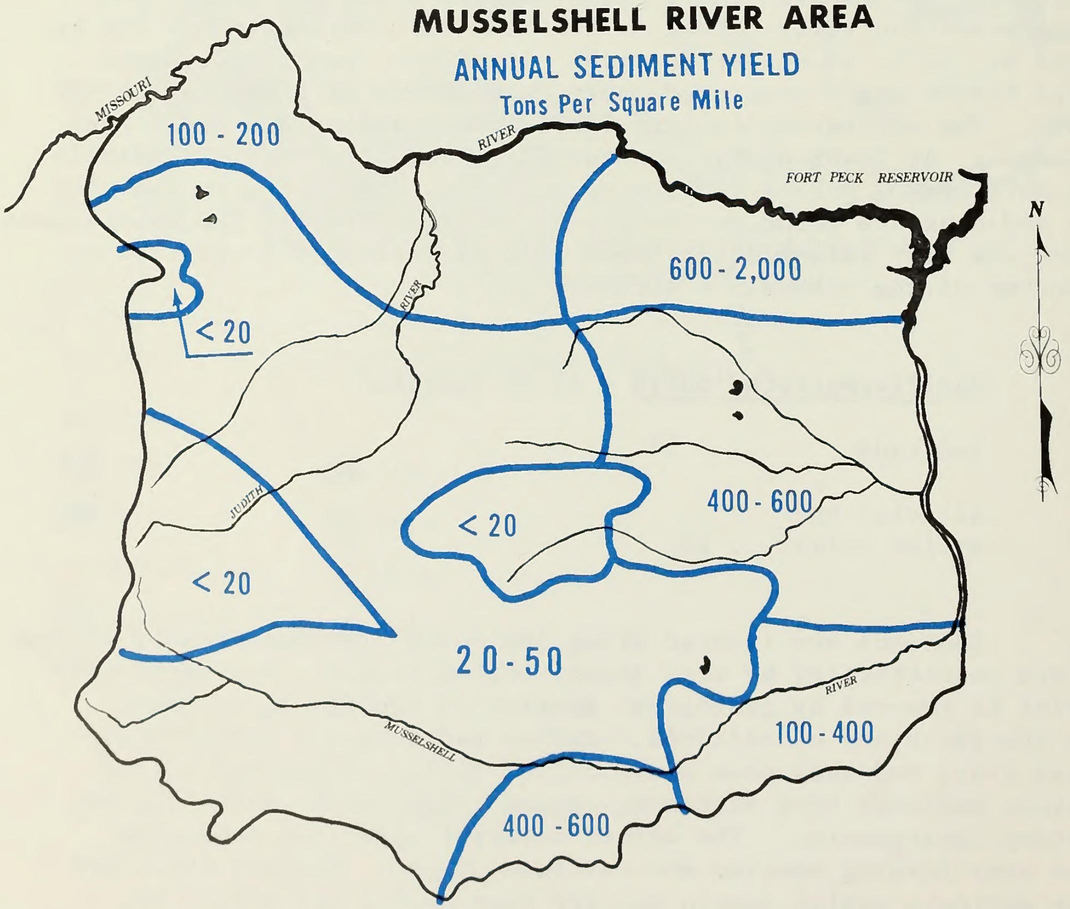


Figure 17

In addition, large amounts of sediment come from the Boxelder Creek drainage in the east-central section where many Land Utilization tracts are located.

The timbered, mountainous regions, most of which are administered by the U.S. Forest Service, produce sediment at a comparatively low rate.

Vegetation

Narratives of early explorers and the photographic pair comparisons in Appendix B show that changes in the subbasin's vegetation come slowly.

Perennial grasses dominate the rangeland. Bluestem (western) wheatgrass and blue grama are the most common, followed in order by prairie junegrass and bluebunch wheatgrass. Needleandthread and green needlegrass are also widely distributed. Inland saltgrass and alkali sacaton grow on saline areas; little bluestem, sideoats grama and prairie sandreed occur on rocky slopes.

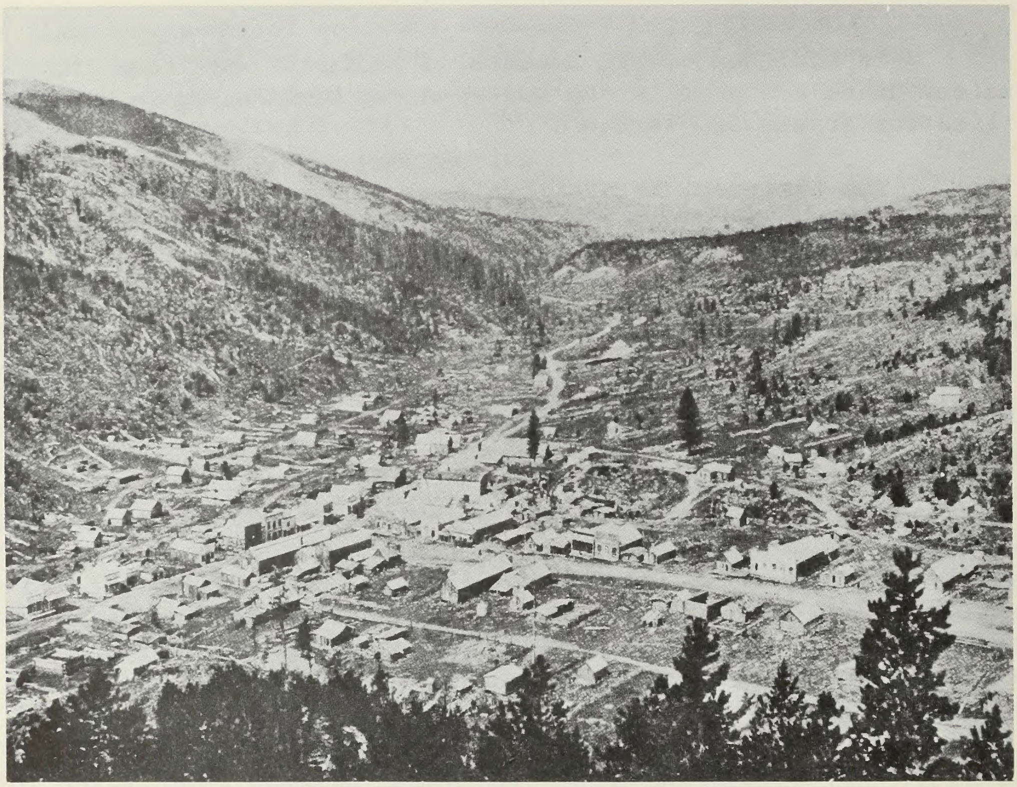
Annual grasses and weeds increase and decrease from year to year with fluctuations in the weather. On some range sites following prolonged drought, annual vegetation may make up 95 percent of the plant composition. The next year it may account for only 10 percent, see Appendix C. Cheatgrass, Japanese brome, and sixweeks fescue are the most common annual grasses and reach 15 percent of the forage composition on 9 percent of the range sites. For details on vegetation, see discussion on public domain, and Appendix B.

Poisonous plants are not abundant. Death camas is encountered most frequently in the spring; at other times of the year it is inconspicuous. Lupine and locoweed are common, but never reach 15 percent of the composition. Crazyweed, larkspur, and horsebrush are relatively rare.

Pricklypear cactus is scattered over the rangeland, but reaches 15 percent of the composition on only 3 range site writeups.

Timber in the subbasin includes ponderosa pine, Douglas-fir, limber pine, lodgepole pine, and Englemann spruce, intermingled with stands of aspen. Cottonwoods occur in the valleys and along small drainages. Ponderosa pine, the most common lumber producer on the public domain, is found on rocky mesas and ridges; it has local value for building and repairs. It grows on 36 percent of the range sites but is important (15 percent or more of total vegetation) on only 8 percent of the sites.

Fringed sagebrush is the most frequently encountered shrub in the subbasin, occurring on 51 percent of the range sites, but is



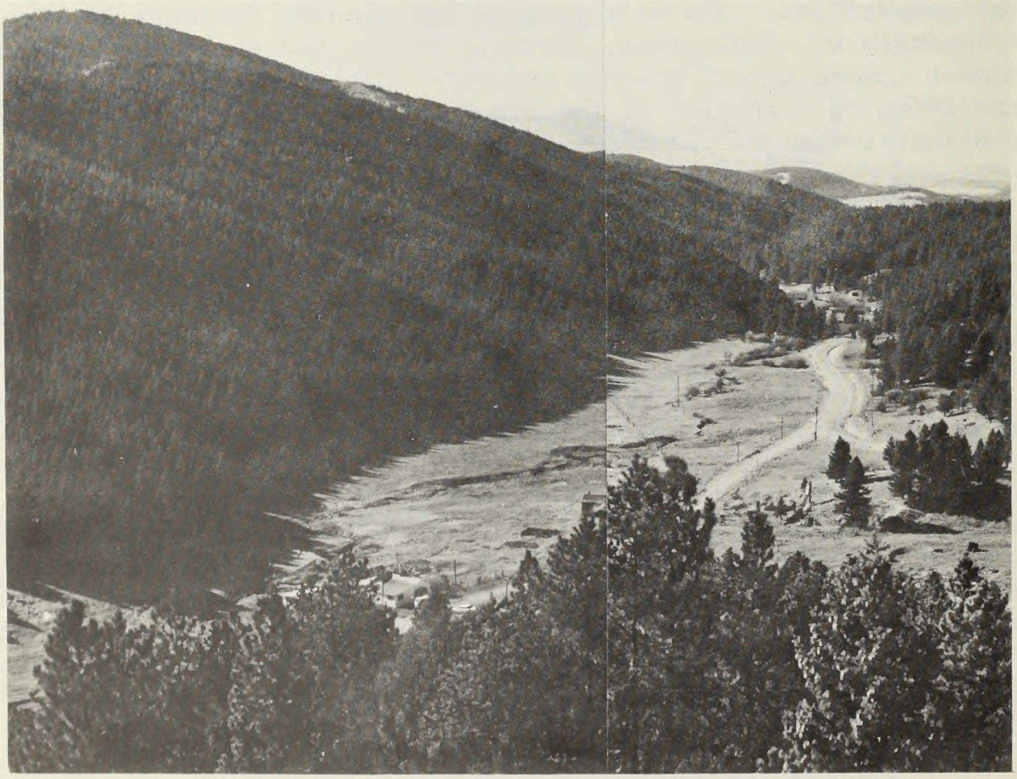


Figure 18. Maiden Canyon, Fergus County. Top photo, Weed 1892. Bottom photo, BLM 1962. Illustrates the timber recovery of the denuded hillsides. Maiden's citizens cut most of the trees and used them for mine timbers, building materials, and firewood.

important on only 1 percent. Big sagebrush, although less common, is important on 14 percent of the sites. Silver sagebrush, broom snakeweed, skunkbrush and rabbitbrush are also common. Rose, currant, snowberry, and greasewood are concentrated into small dense stands due to limitations of topography and soil. Junipers, a common browse of significant value to wildlife, especially deer, occur on 27 percent of the range sites.

Game and Fish

The Musselshell subbasin supports a varied and attractive cross section of wildlife. Most species that were recorded by Lewis and Clark in 1806 can still be found. The buffalo and wolf are notable exceptions.

Elevational differences create environmental conditions that support many ecological niches for big game, fur bearers and upland game. Broad habitat areas are located on Figure 19.

Big Game

With the exception of moose, the Musselshell subbasin has all species of Montana's big game. Whitetail and mule deer are hunted throughout the subbasin. Large populations of mule deer exist in most areas.

The popularity of big game hunting is enhanced by having elk and deer seasons at the same time. Huntable quotas are based on trend studies that reflect the number of animals per unit area. Antlered bull seasons prevail, but either-sex permits are sometimes sold for areas having large elk herds.

Excellent plains antelope hunting is found in the Musselshell subbasin at short distances from mountainous deer and elk ranges. Annual hunting quotas for antelope average about 5,000 animals for the subbasin. Within the hunting units, one huntable antelope is produced on about 2,000 acres. More favorable habitats produce one animal to about 960 acres or one for every 1½ sections. The most antelope are found in the sagebrush-grassland habitat areas.

Mountain goats and Rocky Mountain Bighorn are found in portions of the subbasin. The Crazy Mountains have a huntable goat population. Bighorn transplants in the Missouri River breaks of northeastern Fergus County have produced a sheep population that is occasionally hunted.

Black bear are found throughout the mountainous areas of the subbasin. Although grizzlies are true wilderness species, a few permits are sold each year in Fergus and Judith Basin Counties.

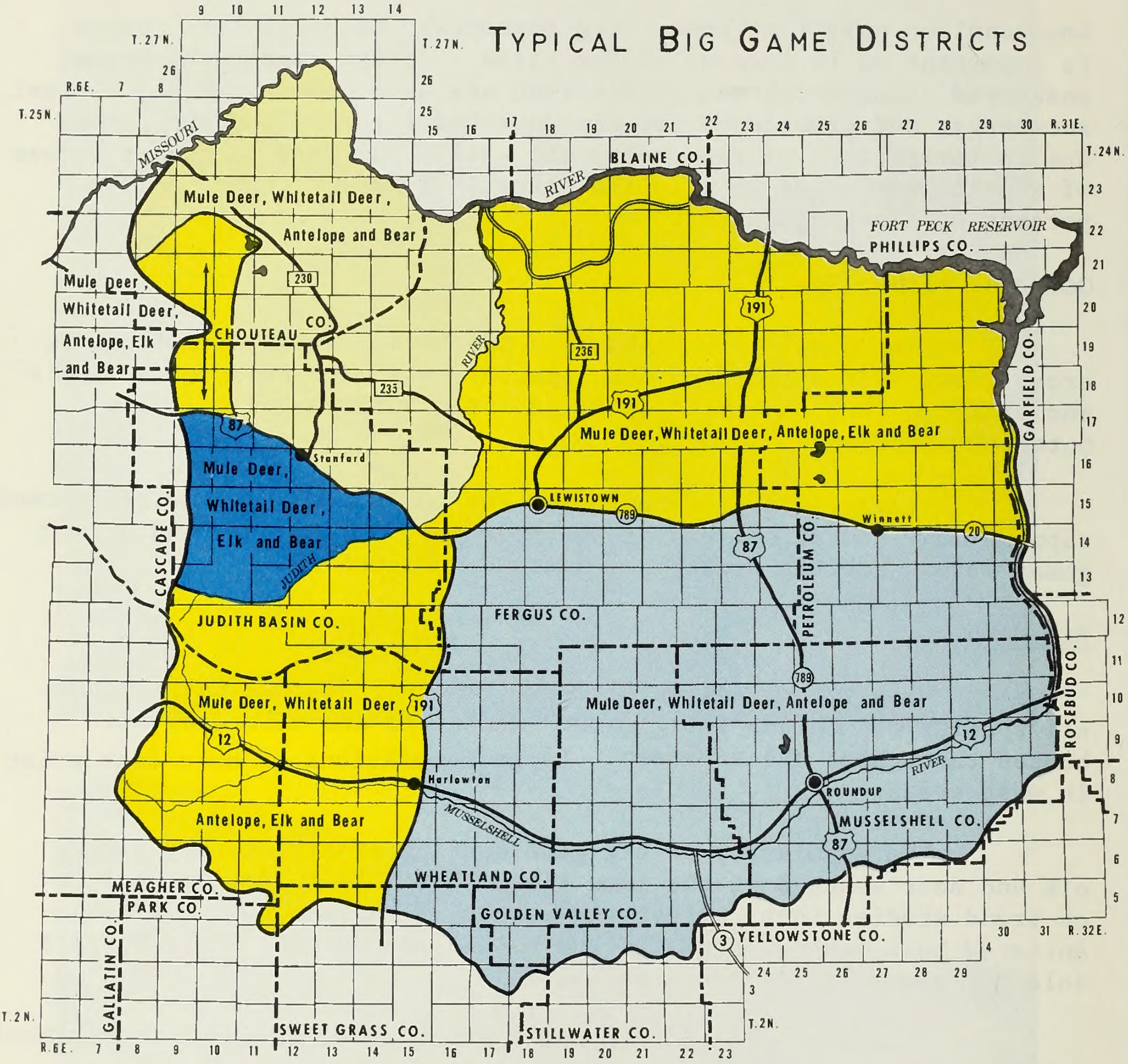

TYPICAL BIG GAME DISTRICTS
Mule Deer, Whitetail Deer, Antelope and Bear
Mule Deer, Whitetail Deer, Antelope, Elk and Bear
Mule Deer, Whitetail Deer, Elk and Bear
Mule Deer, Whitetail Deer, Antelope, Elk and Bear
Mule Deer, Whitetail Deer, Antelope, Elk and Bear
Mule Deer, Whitetail Deer, Antelope and Bear
MISSOURI
RIVER
JUDITH
MUSSELSHELL
FORT PECK RESERVOIR
BLAINE CO.
PHILLIPS CO.
CHOUTEAU CO.
CASCADE CO.
JUDITH BASIN CO.
FERGUS CO.
PETROLEUM CO.
GARFIELD CO.
ROSEBUD CO.
MUSSELSHELL CO.
WHEATLAND CO.
GOLDEN VALLEY CO.
YELLOWSTONE CO.
MEAGHER CO.
PARK CO.
GALLATIN CO.
SWEET GRASS CO.
STILLWATER CO.
Stanford
LEWISTOWN
Winnett
Harlowton
ROUNDUP
87
191
12
20
789
230
235
236
3
T.27N.
T.25N.
T.24N.
T.2N.
R.6E.
R.31E.
R.32E.

Figure 19

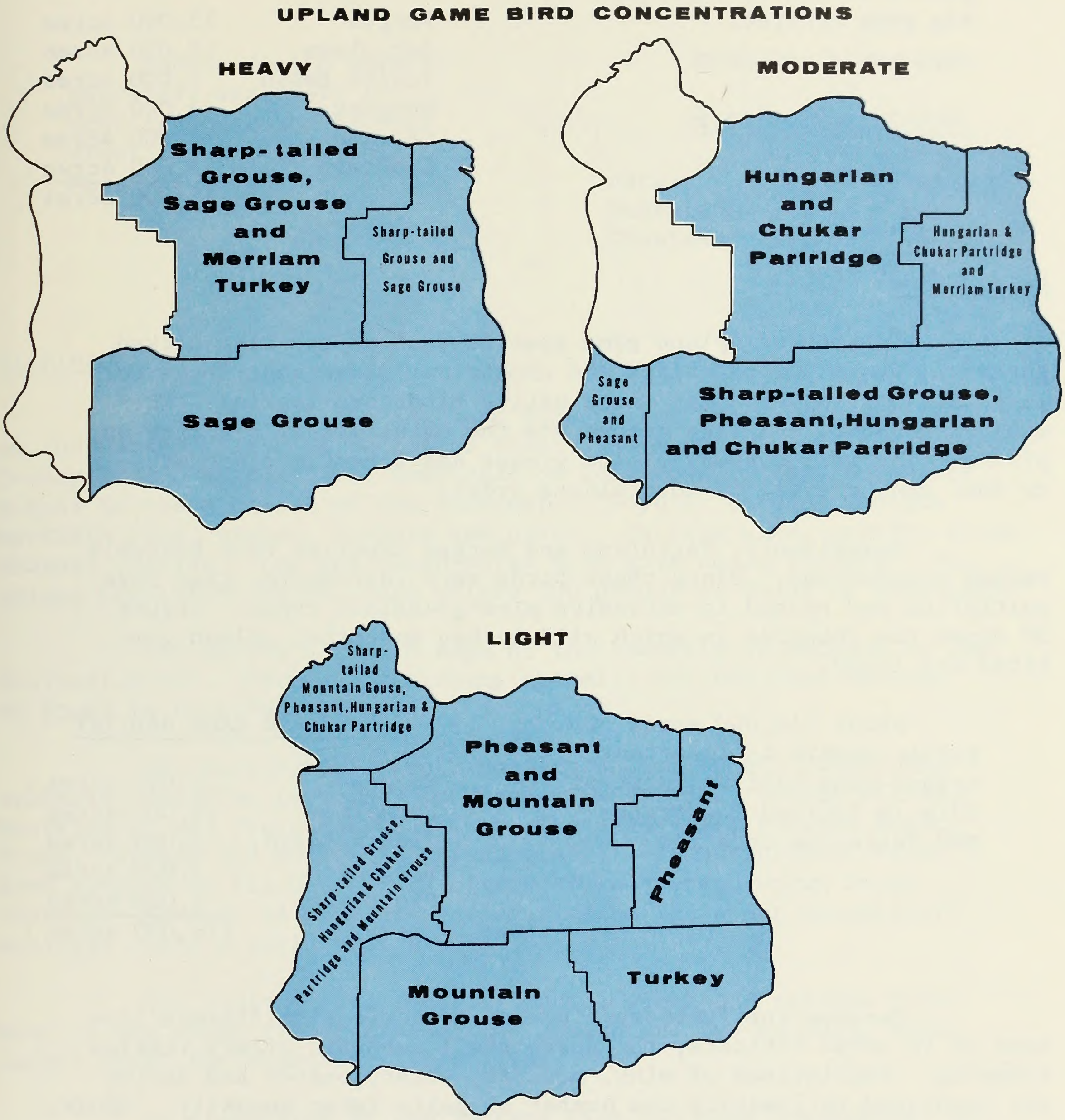

UPLAND GAME BIRD CONCENTRATIONS
HEAVY
Sharp-tailed Grouse, Sage Grouse and Merriam Turkey
Sharp-tailed Grouse and Sage Grouse
Sage Grouse
MODERATE
Hungarian and Chukar Partridge
Hungarian & Chukar Partridge and Merriam Turkey
Sage Grouse and Pheasant
Sharp-tailed Grouse, Pheasant, Hungarian and Chukar Partridge
LIGHT
Sharp-tailed Mountain Gouse, Pheasant, Hungarian & Chukar Partridge
Pheasant and Mountain Grouse
Pheasant
Sharp-tailed Grouse, Hungarian & Chukar Partridge and Mountain Grouse
Mountain Grouse
Turkey

Figure 20

About 64,000 acres of public domain is important big game habitat.

BIG GAME HABITAT	
Fergus	13,000 acres
Petroleum	19,000 acres
Judith Basin	9,000 acres
Meagher	3,000 acres
Cascade	14,000 acres
Chouteau	6,000 acres
	64,000 acres

Upland Game

Introduced upland game species such as the ring-necked pheasant, Hungarian partridge and chukar partridge contribute to excellent hunting on areas where native birds are lacking. The native sharptail and sage grouse are the mainstays of prairies and plains. The ruffed grouse, blue grouse and Franklin's grouse, or fool hen, prevail in mountainous areas.

Musselshell, Petroleum and Fergus Counties have huntable turkey populations. Since these birds were introduced, they have multiplied and spread in extensive pine-grassland types. Figure 20 shows the counties in which wild turkey and other upland game birds are found.

About 114,000 acres of public domain is important upland game habitat; most of this is located in Fergus and Petroleum counties.

UPLAND GAME HABITAT	
Fergus	26,000 acres
Petroleum	79,000 acres
Judith Basin	5,000 acres
Meagher	3,000 acres
Chouteau	1,000 acres
	114,000 acres

Because the furbearers having economic significance live near or in water habitats, the Musselshell subbasin offers limited trapping. Populations of mink, muskrat, otter, beaver and marten are regulated by limiting the number of pelts taken annually. Skunk, badger, bobcat, coyote and rabbit are abundant furbearers, but of limited economic significance.

Waterfowl

The upper extremities of the Fort Peck Game Range provide extensive waterfowl habitat. Ducks and geese also utilize the Missouri and Musselshell Rivers as breeding places. In mild, open winters many species winter on the larger bodies of open water.

Since the subbasin is situated between the Central and Pacific flyways, a wide variety of waterfowl and shore birds are found.

Public domain used by migratory waterfowl for nesting and cover borders about 167 miles of the Missouri River.

MISSOURI RIVER USED BY MIGRATORY WATERFOWL

Fergus	75 miles
Petroleum	25 miles
Chouteau	67 miles
	167 miles

Fishing

A portion of the southern edge of Fort Peck Reservoir runs on the northern line of Petroleum County and along the northeast Fergus County line. Highway 191, northeast of Lewistown, offers immediate access to these shores of the reservoir. Popular catches include northern pike, sauger, crappie and perch. Walleye pike, rainbow trout, channel catfish, ling and fresh-water drum give added variety. The unique paddlefish which often weighs 100 pounds is found in this lake.

The entire northern edge of the subbasin is bounded by the Missouri River. Warm water fishing prevails for the same species as found in Fort Peck Reservoir.

The Musselshell River runs its entire length within the subbasin, draining territory in Meagher, Wheatland, Golden Valley, Musselshell and Petroleum Counties. The headwaters contain brook, brown, rainbow and native cutthroat trout. The Musselshell River from Ryegate to its headwaters offers above-average brown trout fishing. Several of the large reservoirs on the upper Musselshell drainage yield a variety of trout.

The Judith River contains brown, brook and rainbow trout. Many of the upper tributaries of the Judith are fed by cold, clear waters ideal for producing large fish.

As classified by the Montana Fish and Game Commission, the Musselshell subbasin has 50 miles of Class II sport fishing streams. These are streams of recognized statewide significance. There are 190 miles of Class III sport fishing streams in the subbasin, defined as streams of value to large districts of the state. About 560 miles of sport fishing streams are in Class IV, defined as having value to smaller districts such as counties. All classes total nearly 800 miles of sport fishing streams in the subbasin. Those streams not classified have restricted local value or have not yet been classified. Figure 21 shows the streams that have been classified.

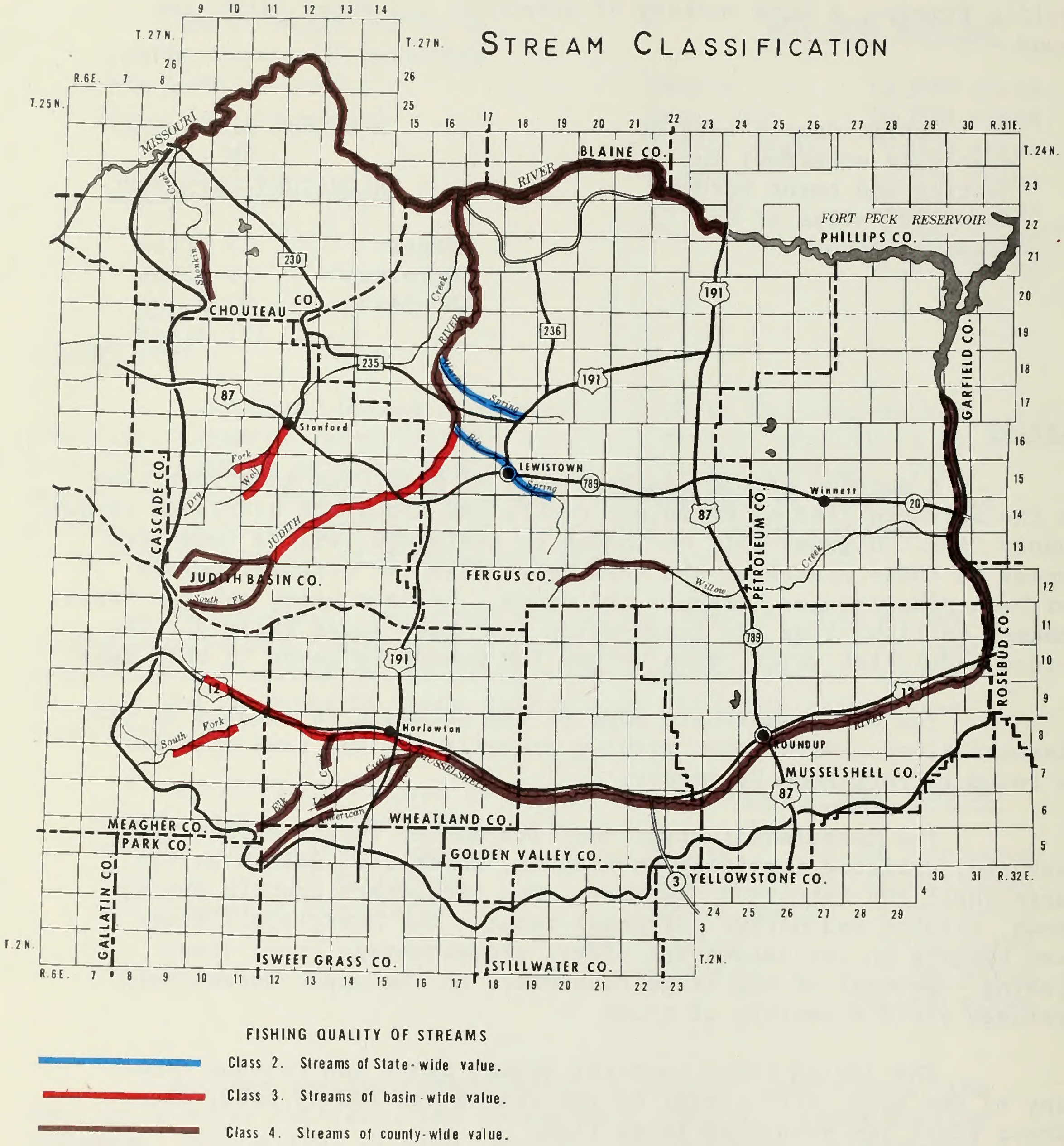

STREAM CLASSIFICATION
FISHING QUALITY OF STREAMS
Class 2. Streams of State-wide value.
Class 3. Streams of basin-wide value.
Class 4. Streams of county-wide value.
MISSOURI RIVER
FORT PECK RESERVOIR
BLAINE CO.
PHILLIPS CO.
CHOUTEAU CO.
CASCADE CO.
JUDITH BASIN CO.
FERGUS CO.
PETROLEUM CO.
GARFIELD CO.
ROSEBUD CO.
MUSSELSHELL CO.
WHEATLAND CO.
GOLDEN VALLEY CO.
MEAGHER CO.
PARK CO.
GALLATIN CO.
SWEET GRASS CO.
STILLWATER CO.
YELLOWSTONE CO.
Stanford
LEWISTOWN
Winnett
Harlowton
ROUNDUP
JUDITH RIVER
MUSSELSHELL RIVER
Shonkin Creek
Wolf Fork
Dry Fork
South Fk
Big Spring
Beaver Spring
Warm Spring
Willow Creek
South Fork
Elk
American
T.27N.
T.25N.
T.24N.
T.2N.
R.6E.
R.31E.
R.32E.
230
235
236
87
191
789
20
12
3

Figure 21

Reservoirs in the subbasin offer good fishing. The prairie areas have many reservoirs which provide sport as well as water for irrigation and livestock. These waters have been stocked with bass, blue gill, crappie, walleyed pike and northern pike. Some provide rainbow trout fishing.

License statistics for 1967 showed resident sales of hunting and fishing permits totaled approximately 21,100 in the Musselshell subbasin counties, and non-resident sales of nearly 1,800. Expenditures for recreational goods and services within the subbasin comprised 6% of the statewide total.

HISTORY

The Early Years

On May 20th, 1805 at eleven a.m., the Musselshell River Area entered recorded history. It was then that the Lewis and Clark expedition reached the mouth of the Musselshell River. But man had already been in this area for thousands of years.

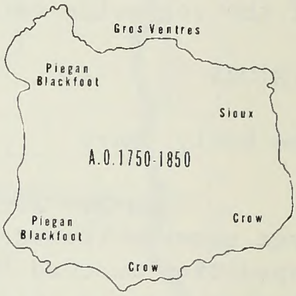
Folsom man hunted throughout Montana and the Musselshell subbasin 10,000 years ago seeking a now-extinct bison. He killed with a throwing stick that hurled spears and darts tipped with fluted stone points. Yuma man followed - he too lived on big game but his stone points were simpler. Their culture lasted for 2,000 years, from 6000 B.C. to 4000 B.C., then collapsed; the herds of big game suddenly vanished, not to reappear for over 4,000 years.

For food man then switched to deer, fox and rabbit and larger amounts of plants. Tools and techniques of harvesting and preparing plants were introduced or invented (one development, the roasting pit for cooking camas and bitterroot, continued in use into modern times).

About 500 A.D. a big-game hunting culture reemerged because the large herds of big game returned. Communal hunting, was refined into large buffalo drives. The bow and arrow with its greater killing power appeared. Movable shelters of hides stretched over a frame and held in place on the ground by stones heaped around the circular base were invented. Thousands of such rings (teepee rings) are evident in Montana, including the Musselshell area.

Within early historic time, the Indians in the Musselshell area were eastern branches of three tribes from west of the Continental Divide. The Plains Kutenai roamed on foot through the grasslands of north-central Montana as far east as the mouth of the Milk River; the Upper Pen d'Oreille, or Tunaxa, headquartered in the Sun River country near Great Falls; the Flatheads inhabited the Yellowstone Valley eastward as far as the Big Horn Mountains.

Then the horse came. Around 1700 the Shoshoni invaded the game-filled northern plains as fighting horsemen wearing armor of leather, sand and glue. The Flathead were thrust westward out of the Yellowstone Basin; the Kutenai and Pen d'Oreille retreated over the Continental Divide.



The Shoshoni could not hold the rich buffalo country. Their cavalry was overwhelmed by strange tribes forced westward by white settlement. These hostile newcomers, armed with muskets and rifles, were now acquiring horses. By 1800, the Crows had forced the Shoshoni from the Yellowstone Valley. To the north, the Blackfeet, with the Piegans in the van, moved west to the Rocky Mountains and then south; the Shoshoni gave way ahead of them. Lewis and Clark in 1805 met the main body of Shoshoni, who by then had retreated west of the Continental Divide into Idaho. Thus, by the time white trappers moved into Montana, the Piegan Blackfeet held the western part of the Musselshell subbasin; the Crows and the Sioux hunted the eastern part; the Gros Ventres centered around the Bear Paw Mountains.

The Upper Missouri country was opened by Lewis and Clark. A member of the expedition, John Colter, dropped out on the return home in 1806 to stay and trap fur. The fur trade expanded rapidly into the riches of the Upper Missouri. Blackfeet, hostile to Americans, held back fur trade for awhile but by 1831 James Kipp built Fort Piegan (the first Fort McKenzie) at the mouth of the Marias River. In 1832 Fort Piegan was replaced by the second Fort McKenzie upstream at Brule Bottoms. Twelve years later, 1844, as a consequence of the murder by a concealed cannon of a large number of Indians, Fort McKenzie was abandoned and the fur post transferred east as Fort Chardon to the mouth of the Judith. Fort Lewis, also erected in 1844 up-river nearer the Great Falls of the Missouri, was torn down and moved downstream seven miles in 1846 to become Fort Benton.

In the earlier years the fur trade was supported by a fleet of keel boats, flatboats, pirogues and mackinaws, which were rowed, sailed, poled or pulled between Fort Benton and Fort Union at the junction of the Yellowstone and Missouri Rivers, then the head of stream navigation. In 1859, the head of navigation for steamboats was extended far upstream. Captain LaBarge with the steamboat "Chippewa" went to Brule Bottoms about 14 river miles below Fort Benton. These few miles were conquered in 1860.

Fort Benton replaced Fort Union as the center of the fur trade on the Upper Missouri. The Mullan Road from Walla Walla to Fort Benton was completed the year that gold was discovered at Bannock in 1862; Fort Benton was confirmed in its commercial eminence because it was the point where river freight was landed and loaded on wagons for overland delivery to the goldfields to the south. Even after the coming of the railroad, Fort Benton remained a transfer point for supplies going overland to Royal Northwest Mounted Police in Canada.

In 1855 at the mouth of the Judith River, Captain Stevens concluded a treaty with the Blackfeet, Piegans, Gros Ventre, and Assiniboine tribes establishing those lands south of the Missouri River and west of the Musselshell River as hunting ground for the Blackfeet. Under the terms of the Fort Laramie Treaty in 1851, the Crows had already been granted the territory south of the Musselshell and west of the Powder River. Then in 1864 gold and copper were found in the Big Belt and (in the Musselshell Basin) Castle Mountains on the Indian hunting grounds.

White miners and traders in large numbers moved into Indian territory and then demanded to be protected. Accordingly, Fort Musselshell at the mouth of the Musselshell River and Camp Cooke at the mouth of the Judith River were built. Fur posts and stage stations that grew into settlements were Camp Lewis (Lewistown), Fort Reed, Judith Gap, Box Elder, Stanford and Lavina; the stage began service between Fort Benton and Billings in 1874. Clagett's Landing near the site of Fort Clagett on the mouth of the Judith River developed into a supply point for the Milk River area to the north and Judith Basin to the south. By 1875, 10,000 head of cattle driven in from the western settlements grazed the Musselshell River Valley. In 1877, 10,000 sheep were trailed from Idaho into the Judith Basin.

The Blackfeet, Crow, and Sioux tribes understandably embittered over broken treaties, shabby treatment and invasion of their hunting grounds, stepped up their harassing tactics, but military reprisals against the Indians after the death of the politically prominent Lt. Colonel Custer in 1876, finally broke them. In 1877, the Nez Perce led brilliantly by Chief Joseph fled to Canada on an embattled trail that crossed the Musselshell area. Joseph's surrender just short of his goal ended the era of Indian wars in Montana.

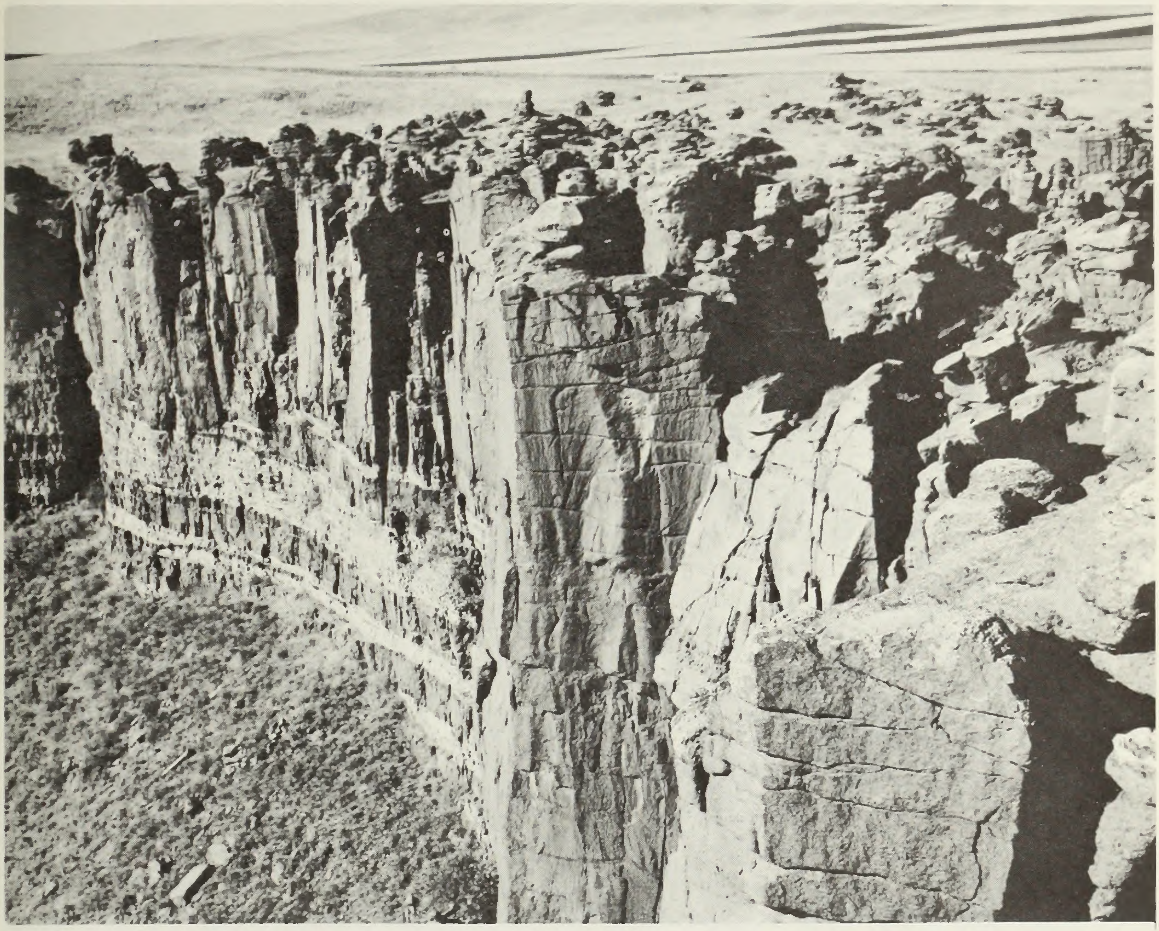
Settlement in the subbasin quickened with the discovery of gold in Yogo Gulch in 1879 and at Maiden in 1880. Then silver was discovered in the Castle mountains in 1882. The number of miners rose. Business opportunities abounded; 17,000 head of cattle were trailed into the region from California and Oregon. By 1884 the buffalo were annihilated by hide hunters and settlers. The ranges were open for livestock.

The longhorn cattle drives from Texas began arriving in 1884. Although the buffalo were gone, the numbers of cattle were already taxing the capacity of the range. As early as 1880 Granville Stuart, scouting for new range in Montana, wrote of the upper Musselshell valley which was an area credited with excellent range in Army reports of 1852 and 1874;

> "...No grass here, eaten into the ground. I wonder that the cattle here did not all die last winter. ... I certainly would not select this for a cattle range but I presume there are five thousand cattle in here now."

Later on cattle did die by the thousands; many livestock companies were wiped out in the disastrous winter of 1886-1887. Stuart wrote an account of that winter, stating the reasons for the death losses and his solution to the problem:

> "Conditions were so changed from what they were in 1880-1881. The thick brush and tall rye-grass along the streams that afforded... excellent shelter at that time was now all fenced in and the poor animals drifted against those fences and perished.
>
> "There was a series of storms in February and while not so severe yet they came at a time when the cattle were least able to withstand them and there were heavy losses then. The cows were all thin and losses in spring calves was about thirty percent.
>
> "The herds that were driven up from the south and placed on the range late in the summer, perished outright. Others lost from seventy-five to eighty percent of their cattle.
>
> "It was impossible to tell just what the losses were for a long time as the cattle drifted so badly in the big January storm. We did not get some of ours back for a year. Our entire losses for the year were sixty-six percent of the herd. In the fall of 1886 there were more than one million head of cattle on the Montana ranges and the losses in the "big storm" amounted to twenty million dollars. This was the death knell to the range cattle business on anything like the scale it had been run on before....
>
> "The large outfits were the heaviest losers as they could not feed or shelter their immense herds.
>
> "The rancher with a good body of hay land and from one hundred to two hundred head of cattle was the man that profited. He had hay enough to feed through



Dry Falls of the Missouri River in Chouteau County. During the Ice Age, the 1,000 foot wide Missouri River roared down this Shonkinite cliff banded with layers of Syenite.

Campsite occupied by Lewis and Clark Expedition on May 31, 1805, en route west to the Pacific Ocean. Location is on Eagle Creek, a tributary entering Missouri River in the spectacular White Cliffs area, upstream from the confluence of the Judith.

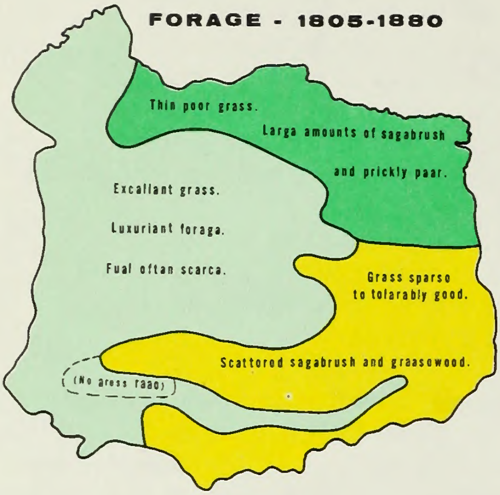
> storms and could gather his cattle around the ranch and partially shelter them, and in the spring he was enabled to buy cattle cheap.
>
> "In the spring of 1887 the ranges presented a tragic aspect. Along the streams and in the coulees everywhere were strewn the carcasses of dead cattle. Those that were left alive were poor and ragged in appearance, weak and easily mired in the mud holes.
>
> "A business that had been fascinating to me before, suddenly became distasteful. I wanted no more of it. I never wanted to own again an animal that I could not feed and shelter."

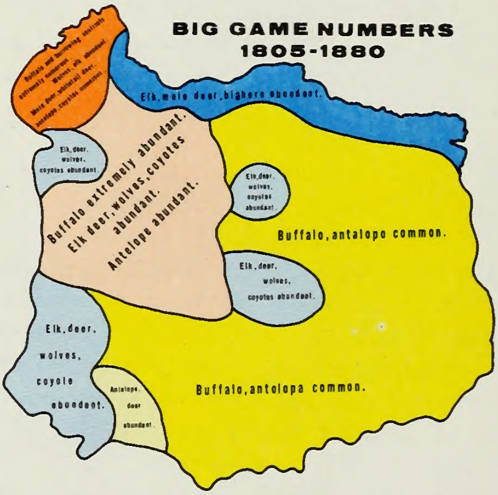
Nine years later in 1896, mining fever was temporarily revived by the discovery of sapphires at Yogo Gulch; the gold and silver boom of the 1880's and 1890's was dying out. Perhaps because of this the railroads were slow in reaching the subbasin. The Montana "Jawbone" Railroad ran from Bozeman to service the region of the Little Belt and Castle Mountains; it entered the Musselshell River Valley in 1902; track was completed into the Judith Basin by the next year.

Railroad companies encouraged the Musselshell Area's mass settlement. The transcontinental route of the Chicago, Milwaukee, St. Paul and Pacific Railroad entered the subbasin near Roundup in 1907; in 1908 it started publicity on the Judith Basin and Musselshell valley, and provided passage at reduced rates for prospective settlers. The Great Northern, beginning in 1909, emphasized the productive land but de-emphasized the limited rainfall. Settlement fever rose through the years and by 1916 the desirable lands were all homesteaded. High prices and demand for wheat in World War I increased farmed acreages. Later, drought and decreased demand for wheat during the twenties brought on the decline in dry-land farming, which hit its lowest level during the depression of the 1930's. Nearly 353,000 acres of marginal farms were purchased during that time by the Federal government under provisions of the 1937 Bankhead-Jones Farm Tenant Act; the tracts are often termed LU Lands from the term Land Utilization Project. The marginal farm land purchased was first administered by the Department of Agriculture, then transferred to the Department of the Interior, which delegated management authority to the Bureau of Land Management.

Early Vegetation and Wildlife

In 1805 the upper Missouri was unknown, untouched by white men and destined for exploration by two intrepid Americans, Meriwether Lewis and William Clark, Captains in the Army. Their plant collections ruined by flood, their detailed descriptions lost by taxonomists, they still provided excellent reports on the strange and often unknown animal and plant life. For the most part, the limits of their observations were from eight to ten miles away from the Missouri River. The immediate scene of the river was described in greater detail.


FORAGE - 1805-1880
Thin poor grass.
Larga amounts of sagabrush
and prickly paar.
Excallant grass.
Luxuriant foraga.
Fual oftan scarca.
Grass sparso
to tolarably good.
Scattorod sagabrush and graasowood.
(No grass raao)


BIG GAME NUMBERS
1805-1880
Buffalo and burrowing animals extremely numerous. Wolves, elk abundant. Mule deer, whitetail deer, antelope, coyotes numerous.
Elk, mule deer, bighorn abundant.
Elk, deer, wolves, coyotes abundant.
Buffalo extremely abundant.
Elk deer, wolves, coyotes abundant.
Antelope abundant.
Elk, deer, wolves, coyotes abundant.
Buffalo, antalopo common.
Elk, deer, wolves, coyotes abundant.
Elk, deer, wolves, coyole abundant.
Antelope, deer abundant.
Buffalo, antolopa common.

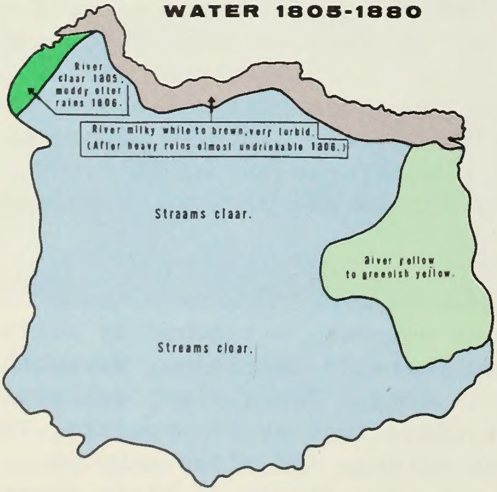

WATER 1805-1880
River claar 1805, muddy after rains 1806.
River milky white to brown, very turbid.
(After heavy rains almost undrinkable 1806.)
Straams claar.
River yellow to greenish yellow.
Streams claar.

Figure 22

Wild roses filled the river bottoms; half of the daily journals at the sixteen camps from May 21 to June 13 in the Musselshell Subbasin, note the abundance of wild rose. Cottonwood trees were of undependable distribution, and often few in quantity, but when groves of these trees were found, they were greatly appreciated by explorers in need of fuel and shelter. The honeysuckle bush was sometimes abundant in the stream bottoms. Buffaloberry was scarce. Pine and cedar were common, although not over-abundant between the Musselshell and Judith Rivers.

In the Lewis Clark journals, grass was habitually described as being short, poor, sparse or as covering the ground with difficulty. An invariable companion statement was one in which immense quantities of pricklypear cactus were noted. Chokecherry, yellow and red currants, and gooseberries were abundant along the Missouri above the mouth of the Marias River.

Buffalo in great numbers were observed in the vicinity of the present sites of Fort Benton and Great Falls. Here, also, were the greatest concentrations of pricklypear cactus, plus mile on mile of "barking" or "burrowing squirrels", and thousands of nesting birds feeding on myriads of grasshoppers which covered the ground. The "barking squirrels" or prairie dogs, and the pricklypear cactus were also reported as being abundant in the northeast section of the Musselshell Drainage.

The most feared wildlife encountered on the trip was the grizzly bear. The number of grizzlies grew from the Judith River westward; they were reported as being dependably ferocious. Black bears did not stay on the plains or river valleys and were not seen during the Lewis and Clark Expedition.

Wolves were abundant on the buffalo range. Beaver, otter, coyotes and jackrabbits were mentioned; antelope although common in several areas apparently made up a relatively small percentage of the total wildlife population.

The elk and deer living in breaks along the Missouri River, maintained their number east of the Judith River into the 1880's. The plains of the Musselshell were also populated by buffalo, wolves, and antelope in large number until 1880. Hide hunters rapidly reduced the game populations, however. As early as 1860, Captain Raynolds of the Army recommended that the wildlife be protected by regulations governing persons who exploited the seemingly large numbers of animals. By 1874 this concern for wildlife had grown widespread. Whatever action was taken, however, proved to be too little and too late.

According to one contemporary account, the era of open plains changed so abruptly that the transition could almost be measured as a matter of months. Granville Stuart, familiar with the Musselshell Area and with Montana in general, provided the following summary:

> "It would be impossible to make persons not present on the Montana cattle ranges realize the rapid change that took place on those ranges in two years. In 1880 the country was practically uninhabited. One could travel for miles without seeing so much as a trapper's bivouac. Thousands of buffalo darkened the rolling plains. There were deer, antelope, elk, wolves, and coyotes on every hill and in every ravine and thicket. In the whole territory of Montana there were but two hundred and fifty thousand head of cattle, including dairy cattle and work oxen.
>
> "In the fall of 1883 there was not one buffalo remaining on the range and the antelope, elk, and deer were indeed scarce...."

ECONOMIC AND SOCIAL DEVELOPMENT

Sources of Income

The basic source of income in the Musselshell subbasin is agriculture. Net farm earnings totaled about 54 percent of nearly $87 million total net earning in 1966. Agriculture employs 33 percent of the subbasin's work force. Since 1930, the number employed in agriculture has declined.

Private non-farm net earnings amount to 46 cents of the net income dollar in the subbasin. Services and sales together employ 39 percent of nearly 7,500 people in the total work force. As shown in Figure 23 twenty seven cents of the net income dollar comes from these two activities.

Transportation, communication, utilities and construction contribute 10 percent of the basin's economy.

Median family income for the subbasin counties averages about $5,400 per year. This median income is below the average for all families within the State.

The non-commodity producing industries have provided most of the recent economic gains. With agricultural employment reduced, and only minor increases in manufacturing, trade and services are absorbing more of the labor force. Continued urbanization, rising income with more leisure time, and expansion of trade and service industries account for gains in the non-commodity producing industries.

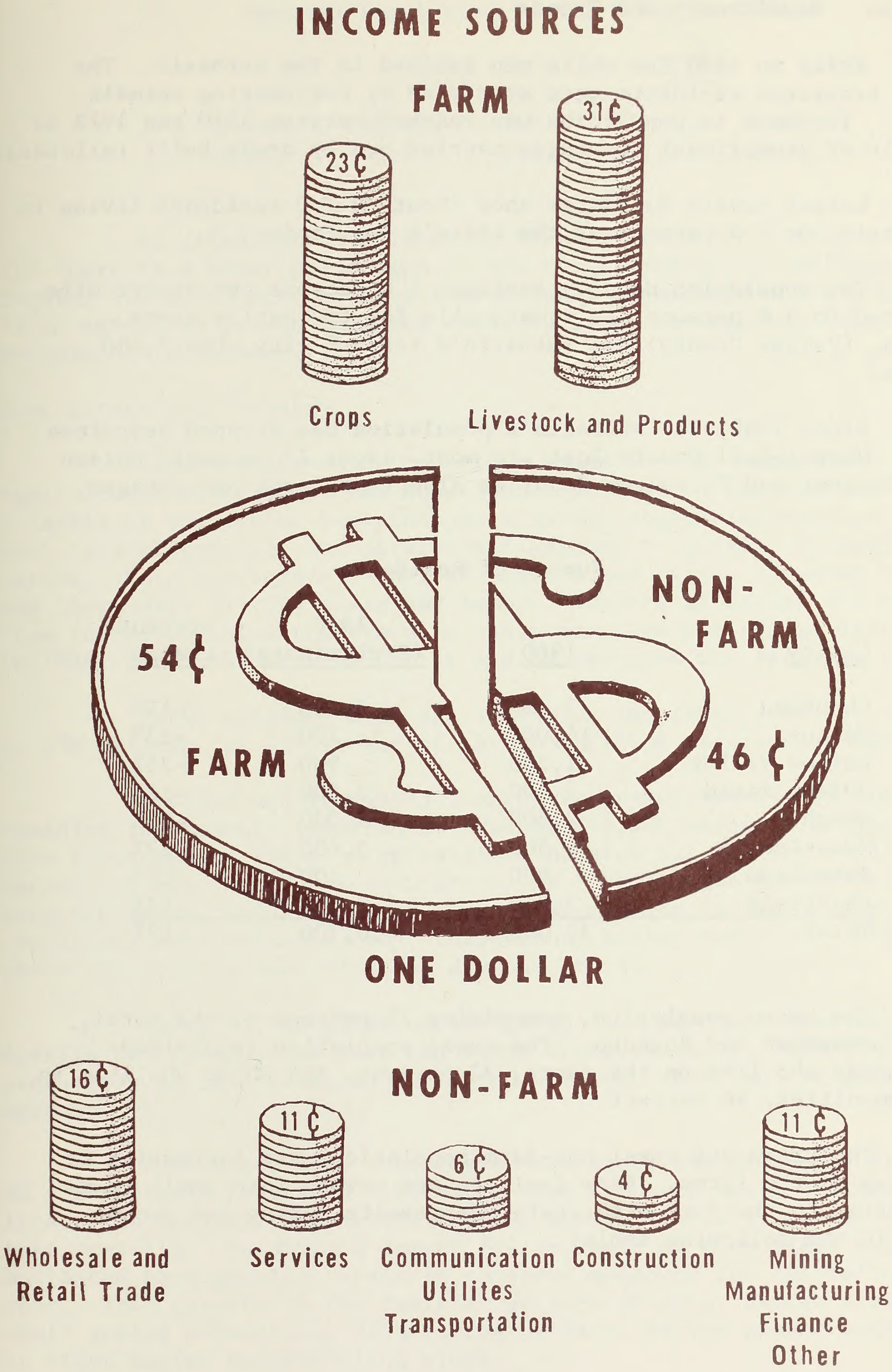

INCOME SOURCES
FARM
23¢
31¢
Crops
Livestock and Products
54¢
FARM
NON-FARM
46¢
ONE DOLLAR
NON-FARM
16¢
11¢
6¢
4¢
11¢
Wholesale and Retail Trade
Services
Communication Utilites Transportation
Construction
Mining Manufacturing Finance Other

Figure 23

Population - Development and Trends

Prior to 1870 few white men resided in the subbasin. The earliest transient residents were attracted by fur-bearing animals and gold. The peak in population was reached between 1910 and 1920 as the result of promotional campaigns carried out by newly built railroads.

Latest census estimates show about 30,700 residents living in the subbasin, or 4.5 percent of the state's population.

The population density averages 1.8 persons per square mile as compared to 4.6 persons per square mile for the entire state. Lewistown, (Fergus County) the subbasin's largest city, has 7,400 residents.

Since 1960, the subbasin's population has dropped seventeen percent. Musselshell County lost the most, about 27 percent; Golden Valley, Meagher and Petroleum Counties also lost large percentages.

Number of Residents

County	1960	1970 (Preliminary)	percent change
Chouteau	7,300	6,200	-15%
Fergus	14,000	12,200	-13%
Golden Valley	1,200	900	-25%
Judith Basin	3,100	2,600	-16%
Meagher	2,600	2,000	-23%
Musselshell	4,900	3,600	-27%
Petroleum	900	700	-22%
Wheatland	3,000	2,500	-17%
Total	37,000	30,700	-17%

The urban population, comprising 28 percent of the total, lives in Lewistown and Roundup. The rural population is divided between those who live on the farms, 32 percent, and those who live in small communities, 40 percent.

The urban and rural non-farm populations are increasing at the expense of the farms. Farm families are moving into small towns and commuting to the farm with statewide results during one decade as shown in the following table:

Montana Population Trend, Farms to Cities

	1950		1960	
Urban	258,000	44%	338,500	50%
Rural	333,000	56%	336,000	50%

As urbanization increases, three effects are evident: (1) there is a lower percentage of the total work force employed in farming (2) farms are becoming increasingly mechanized and (3) there is an egress of people from the subbasin since alternative local employment is limited.

Agriculture and Forestry

Livestock ranching on native range is the fundamental agricultural activity of the Musselshell subbasin. The limited rainfall of the plains has produced a native vegetative complex of short and midgrasses, and shrubs well adapted to grazing by beef cattle, sheep and horses. In 1968, cattle and calves numbered 353,000 and there were 134,000 sheep and lambs. Numbers of cattle and calves show increases while the trend in sheep and lamb numbers is declining. In 1968, total shipment of cattle and calves from the area was 151,000.

Total receipts from all livestock and their products amounted to $28 million, or 49 percent of the $57 million received by agriculture.

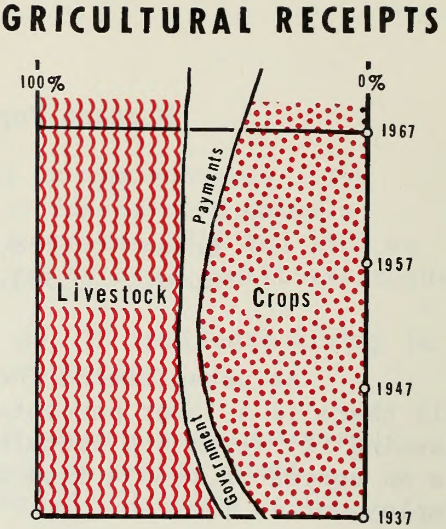
Dryland and irrigated farming is ranked second to livestock ranching in economic importance. Nearly 875,000 acres of cropland were harvested in 1967. Crop receipts totaled $21 million or 37 percent of the total agricultural income. Wheat, the number one crop harvested, had a value of almost $20 million in 1967. Hay was the second most valuable crop, followed by barley and oats. Figure 24 shows the major areas producing dryland crops.

About 95,000 acres of irrigated land was harvested in 1967. Alfalfa hay remains the most important irrigated crop. Alfalfa seed production is important and irrigated wild hay makes up a significant acreage.

Even where deep soils have developed, the semi-arid climate of the subbasin restricts cultivated cash crops to small grains, and it also is largely responsible for the summer fallow system of farming that prevails. In dryland summer fallow, half of each field remains unplanted each growing season to conserve moisture for the following year. This results in the familiar pattern of long, narrow strips of small grains alternating with strips of bare, fallow ground oriented at right angles to prevailing winds.

Irrigated crops are less dependent on seasonal precipitation, but they must be cold-resistant. The importance of this is shown by the length of the relatively cool and short growing season.

Government payments to agricultural enterprises totaled about $7 million.



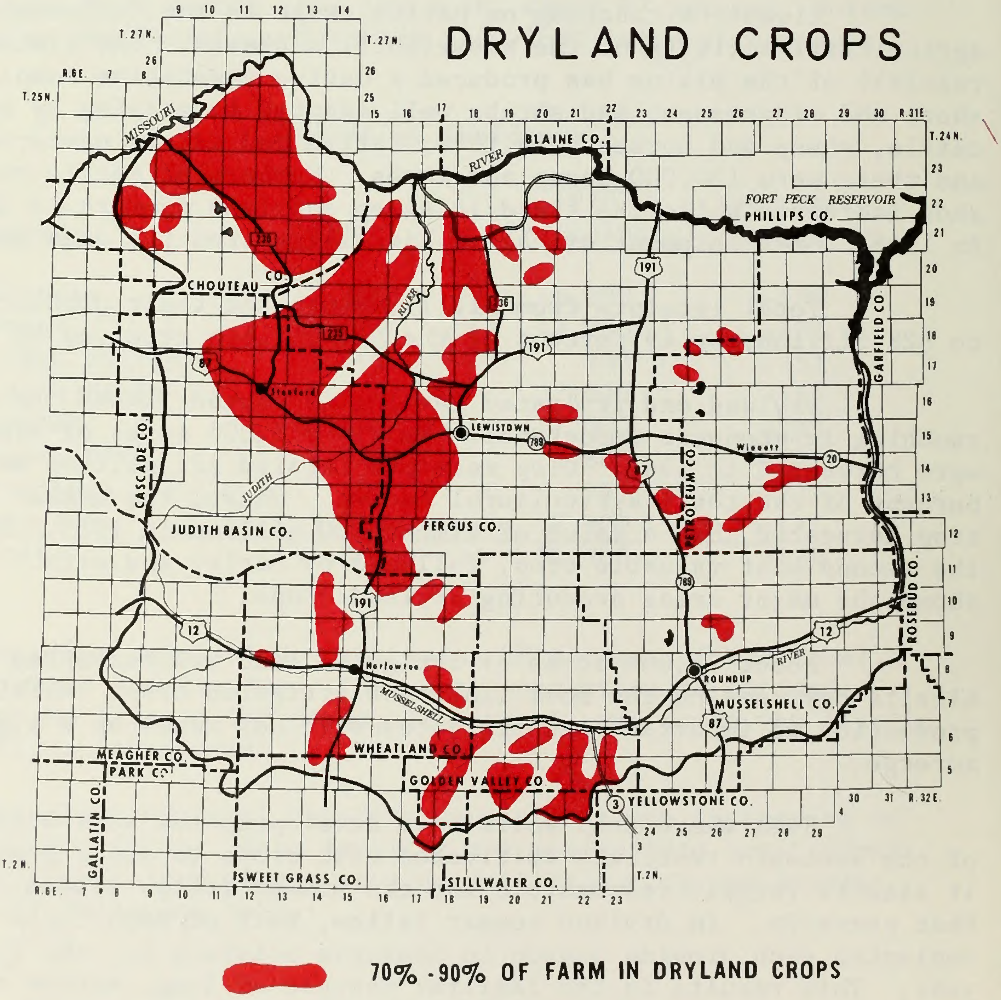


Figure 24

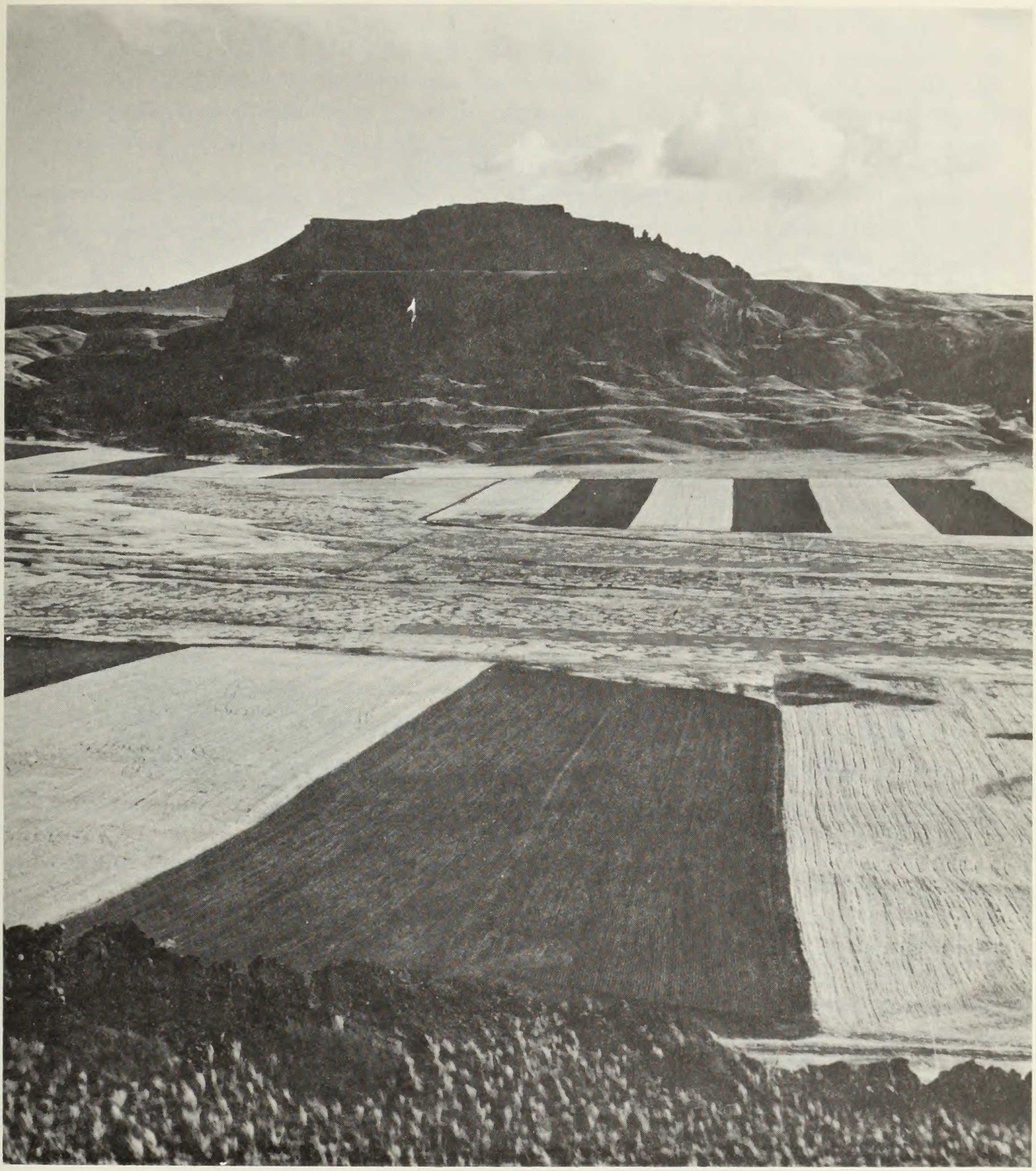


Figure 25. Dryland wheat farming in the ancient bed of the Missouri River. Alternating strips of fallow and cultivated ground are oriented at right angles to prevailing westerly winds, to reduce erosion. Square Butte is seen in background, south of observer.

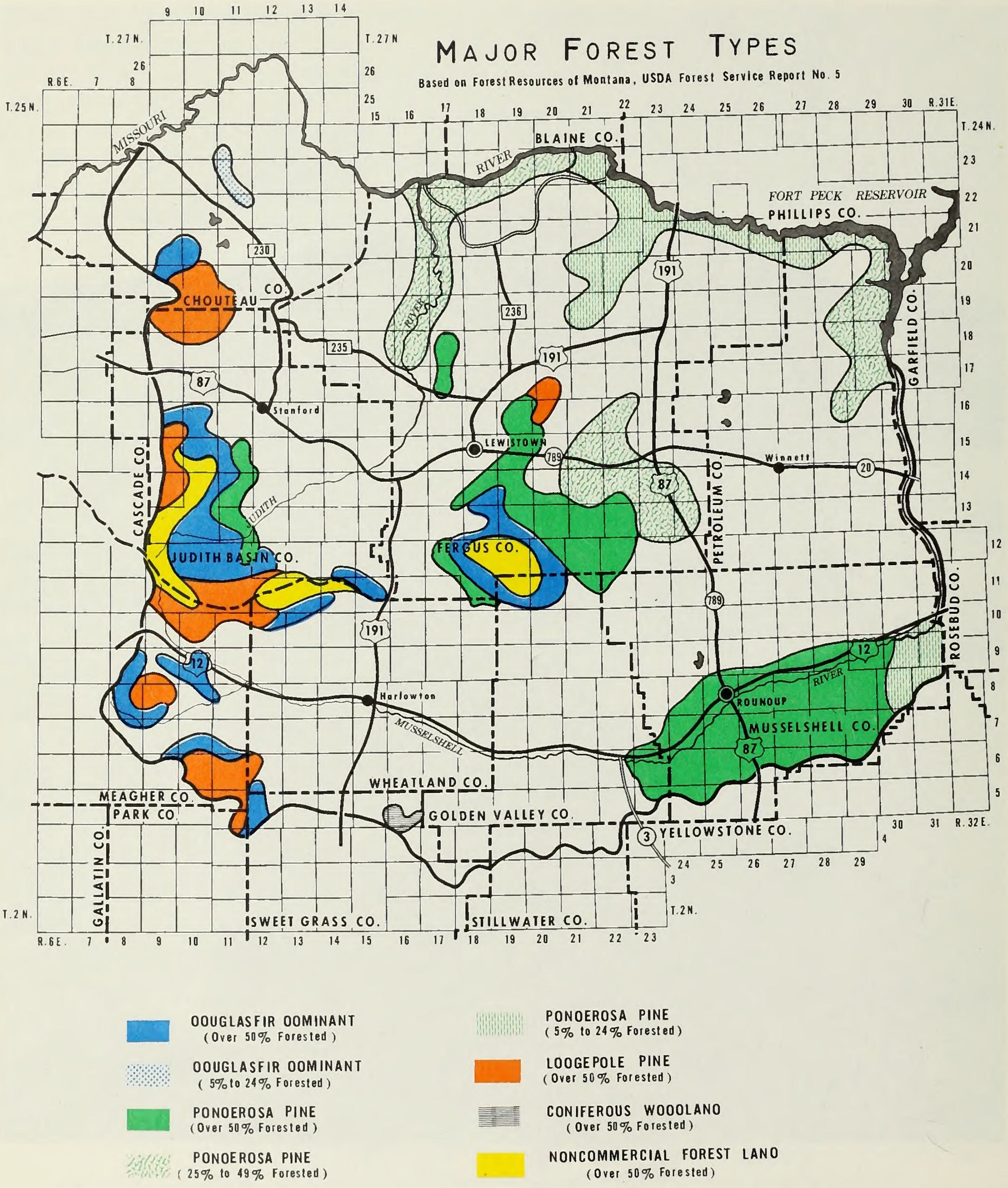
 MAJOR FOREST TYPES
Based on Forest Resources of Montana, USDA Forest Service Report No. 5
MISSOURI
RIVER
BLAINE CO.
FORT PECK RESERVOIR
PHILLIPS CO.
GARFIELD CO.
CHOUTEAU CO.
CASCADE CO.
JUDITH BASIN CO.
JUDITH
Stanford
LEWISTOWN
FERGUS CO.
PETROLEUM CO.
Winnett
ROSEBUD CO.
Harlowton
MUSSELSHELL
WHEATLAND CO.
MEAGHER CO.
PARK CO.
GALLATIN CO.
GOLDEN VALLEY CO.
ROUNDUP
MUSSELSHELL CO.
YELLOWSTONE CO.
SWEET GRASS CO.
STILLWATER CO.
T.27N.
T.25N.
T.24N.
T.2N.
R.6E.
R.31E.
R.32E.
DOUGLASFIR DOMINANT (Over 50% Forested)
DOUGLASFIR DOMINANT (5% to 24% Forested)
PONDEROSA PINE (Over 50% Forested)
PONDEROSA PINE (25% to 49% Forested)
PONDEROSA PINE (5% to 24% Forested)
LODGEPOLE PINE (Over 50% Forested)
CONIFEROUS WOODLAND (Over 50% Forested)
NONCOMMERCIAL FOREST LAND (Over 50% Forested)

Figure 26

The income from farming has not kept up with necessary capital investment in land and buildings. The capital investment in Montana farms and ranches was over $2 billion in 1959; net return on this investment was less than 1 percent. In 1950 the farm and ranch investment was less than $1 billion, and net return was 2.38 percent.

In common with the rest of the United States, farms and ranches in Montana have been diminishing in number since 1920. In the Musselshell River subbasin they decreased at an average rate of 35 per year between 1954 and 1964; at the same time, average size increased about 74 acres per year. Across the state of Montana, farms and ranches decreased in number from 33,000 to 27,000 while average size increased from 1,860 acres to 2,440 acres.

Forested areas of the Musselshell subbasin are shown on Figure 26. Public and private forest lands total about 1.2 million acres. Major timber species include ponderosa pine, Douglas-fir and lodgepole pine.

The Lewis and Clark National Forest, with approximately 645,000 acres of timberland within the basin, has an average annual cut of 7.1 million board feet of timber. About 6 million board feet are saw timber while the remainder is cut for posts and poles and pulpwood. Nearly all timber cut from the National Forest comes from Judith Basin and Meagher Counties.

Timbered private lands generally support livestock grazing. Firewood, posts and poles are the principal forest products cut and sold from these lands. There are limited sales of saw timber from several ranches in Fergus and Musselshell Counties.

The public domain in the Musselshell subbasin includes 157,000 acres of timber, nearly 47 percent of which is in ponderosa pine, lodgepole pine and Douglas-fir. The public domain supplies posts and poles for local use. In addition to their commercial value, the public timberlands provide watershed protection, wildlife habitat and recreational areas.

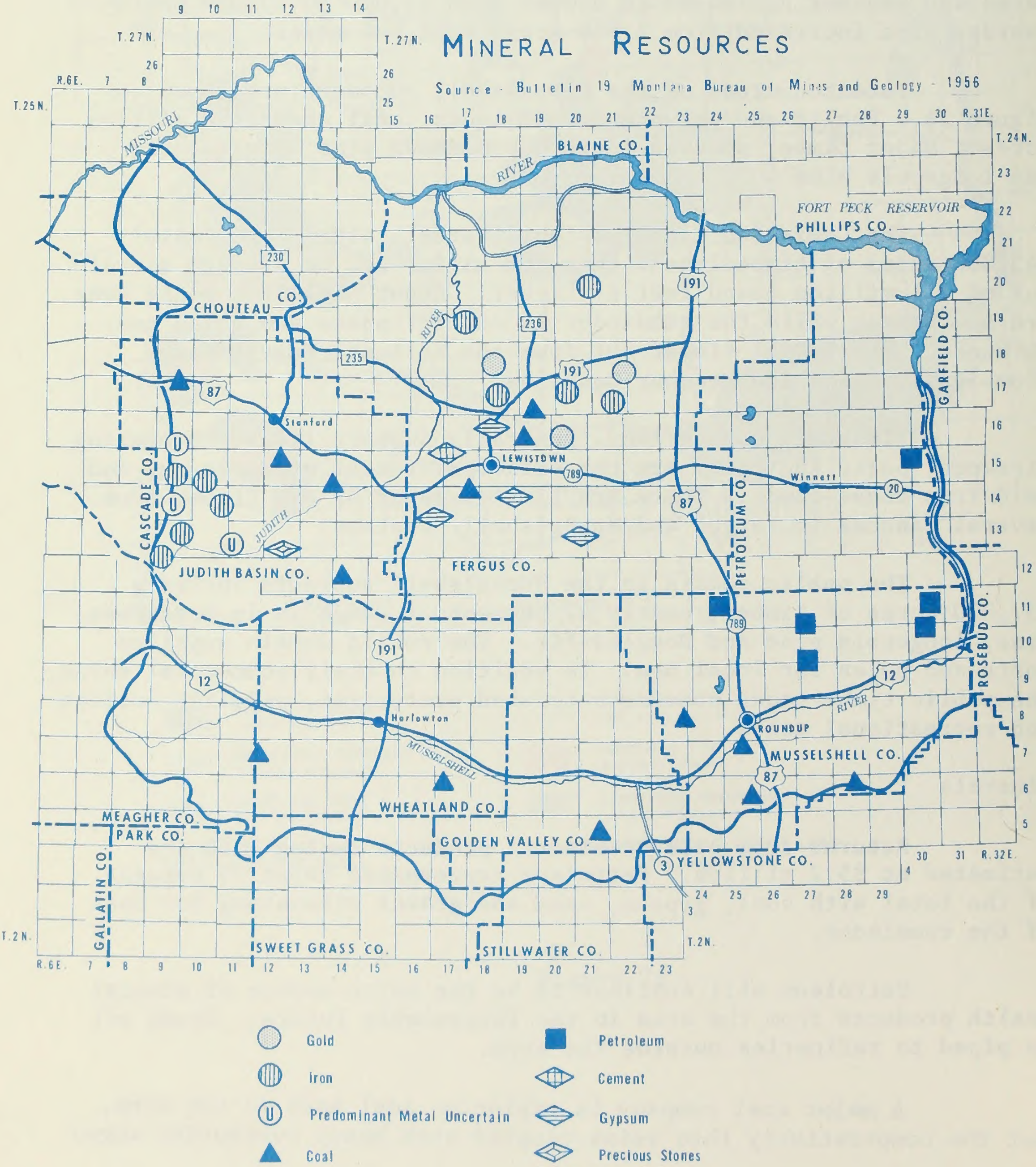
Minerals

Returns from sale of mineral products during 1968 are estimated at $5.2 million. Petroleum represented about 75 percent of the total with coal, gypsum, sand and gravel accounting for most of the remainder.

Petroleum will continue to be the major source of mineral wealth produced from the area in the foreseeable future. Crude oil is piped to refineries outside the area.

A major coal company is exploring coal beds in the area, but the comparatively thin veins coupled with heavy overburden argue against major development. New Federal mine safety requirements become effective in 1970. Additional costs to the operators may curtail the six small underground mines in the area.

The North Moccasin area and the Judith Mountain area in Fergus County have been the location of extensive mineral exploration during the last three years. The two areas produced gold and silver in the early days but have been shut down since World War II. If large tonnages of low-grade gold ore are discovered, open pit mining may be feasible. The Anaconda Company, and other mining concerns have large holdings in the Judith Mountains.



Source - Bulletin 19 Montana Bureau of Mines and Geology - 1956

Figure 27

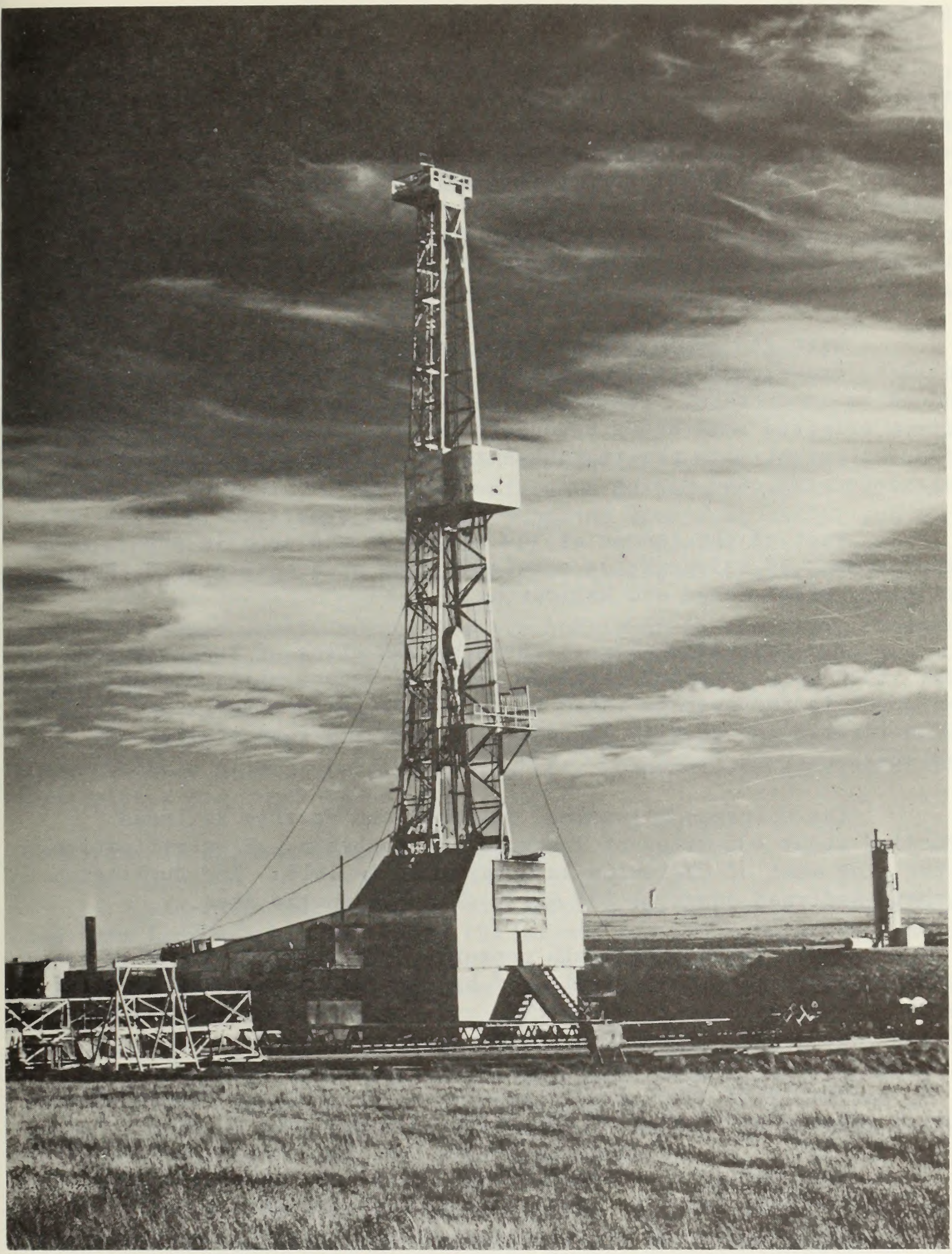


Figure 28. Petroleum represents about 75 percent of the more than $5 million annual mineral receipts in the Musselshell Subbasin. Crude oil is piped to refineries outside of the area. Photo credit Bureau of Mines.

Transportation, Communications, and Utilities

Early transportation in the Musselshell subbasin included methods of travel familiar to both the Indians and white man. Overland transportation was by foot, horseback, pack animal and horse or dog drawn travois. Water transportation was by canoe, bullboat and keelboat. As settlement progressed, oxen and horse-drawn wagons were utilized. Swifter travel was introduced by the stagecoach as roads improved. River travel was improved by steamboat, starting in 1860 with the arrival of the Chippewa at the docks of Fort Benton on the Missouri River.

With the coming of the railroad in the early 1900's steamboat travel and other overland transportation methods were reduced in importance. The reorientation of the transportation pattern affected some areas adversely but in general the railroads aided settlement with the improvements they brought to ranching, dryland farming, and mining.

Part of the impact of the railroads was seen in the establishment of railheads or service points such as Winifred, Roy, Geraldine, Grass Range and Harlowton.

Two rail lines have a total of 590 miles of track in the area. Each mile of track services about 29 square miles of land area which is the average ratio for the State of Montana. The national ratio is one mile of track for every 14 square miles of land area.

The Chicago, Milwaukee, St. Paul and Pacific Railroad maintains about 435 miles of track in the subbasin. Electrification of the line west of Harlowton was completed in 1916. The Burlington Northern Railroad operates 155 miles of track in the area.

Early in the twentieth century, the expanding use of automobiles demanded construction of highways. The establishment of the State Highway Commission in 1913 and the enactment of the Federal Aid Road Act in 1916 assured improved roads.

There are about 700 miles of paved highway in the subbasin; this is augmented by nearly 1,100 miles of unsurfaced roads.

Considering the total mileage, there are about 8 square miles of land area per mile of highway in the subbasin, compared to about two square miles of land area per mile of highway statewide.

Total traffic in 24 hours on all through highways averages 2,400 vehicles. The heaviest traffic flow is north-south on State Highway 3 from Billings to Lavina.

Out-of-State vehicle traffic is heaviest on U.S. Highway 12 through the upper Musselshell River Valley. Commercial and out-of-state traffic combined comprise about 40 percent of the traffic load on this east-west highway.

East-west U.S. Highway 87 through Lewistown ranks second as a commercial and foreign vehicle route.

Major north-south routes include U.S. 87 from Billings north through Roundup and U.S. 191 from Big Timber north through Lewistown.

Bus and airline routes serve the subbasin. An airline connecting Lewistown to Great Falls and Billings, gives access to national and international routes.

Most radio and television communications originate from outside the subbasin. Lewistown maintains an Intermountain Network radio station. Billings transmits programs from four radio, and two television stations into the area. Great Falls stations transmit into the region from four radio and two television stations.

Seven weekly newspapers are published in the area. Lewistown has a daily newspaper to supplement sales of the Billings and Great Falls papers.

Most of the electric power is supplied by one company from hydroelectric generators at Great Falls. Cooperatives service small communities and rural areas.

Commerce, Trade, and Community Services

In 1966, the subbasin had about 2,700 employees working in non-farm industries. Including the income for all proprietors, total earnings amounted to $23 million from these industries. Sales and service enterprises produce income second to agriculture in the Musselshell subbasin.

In 1967, there were 31 fewer retail sales establishments than in 1963. Total receipts, however, amounted to $38 million or about $3 million more than 1963 receipts. Greatest gains were noted in Fergus, Golden Valley, and Wheatland Counties.

Wholesale establishments declined by 18 by 1967. The 104 businesses in 1963 received about $6 million less than the $30.3 million made by 86 establishments in 1967. Greatest gains were noted in Fergus and Judith Basin Counties.

Major service enterprises from 1963 to 1967 showed declines in total receipts and number of establishments. In 1967, 129 selected service establishments of the Musselshell basin had total receipts of $2.1 million or about 1.8 percent of the State's total reciepts.

Overall trends show fewer sale and service enterprises, with greater receipts per establishment, employing about the same number as before.

Manufacturing, public utilities and transportation show economic growth and gains in employment. Major population centers of the subbasin, such as Lewistown and Roundup, register the major gains. Musselshell County shows the only increased employment in mining.

Small elementary schools are scattered throughout the isolated rural areas. High schools are located in the larger towns; the students move into town or are bussed to the schools to finish their education.

Public libraries are located in Lewistown, Harlowton, Roundup and Winnett.

Lewistown has the only hospital in the subbasin but medical facilities are available in all of the larger towns.

Service industries and retail and wholesale stores are concentrated in the county seats.

Outdoor Recreation

Montana's travel industry ranks third in economic importance after agriculture and mineral production. In 1968, out-of-state visitors provided seventy-three percent of Montana's $163 million recreational income. Montana, however, contributed the greatest number of recreationists.

Tourists drive through the Musselshell subbasin on their way to nationally known Yellowstone and Glacier National Parks. Nineteen out of twenty tourists travel by car; the leading states of origin are California, Washington, Minnesota and Illinois.

Tourists and local residents enjoy sightseeing, picture-taking, visiting historical sites, fishing and wildlife activities. Fishing and big game hunting are the two major outdoor sport activities of residents and non-residents in the subbasin.

Statistics (1968) on tourist travel in Montana show an average tourist party of three spends $102 while staying 3.5 days in the State. Most expenditures by visitors are paid to service oriented, non-commodity producing industries. The typical tourist dollar is spent as shown in Figure 29.

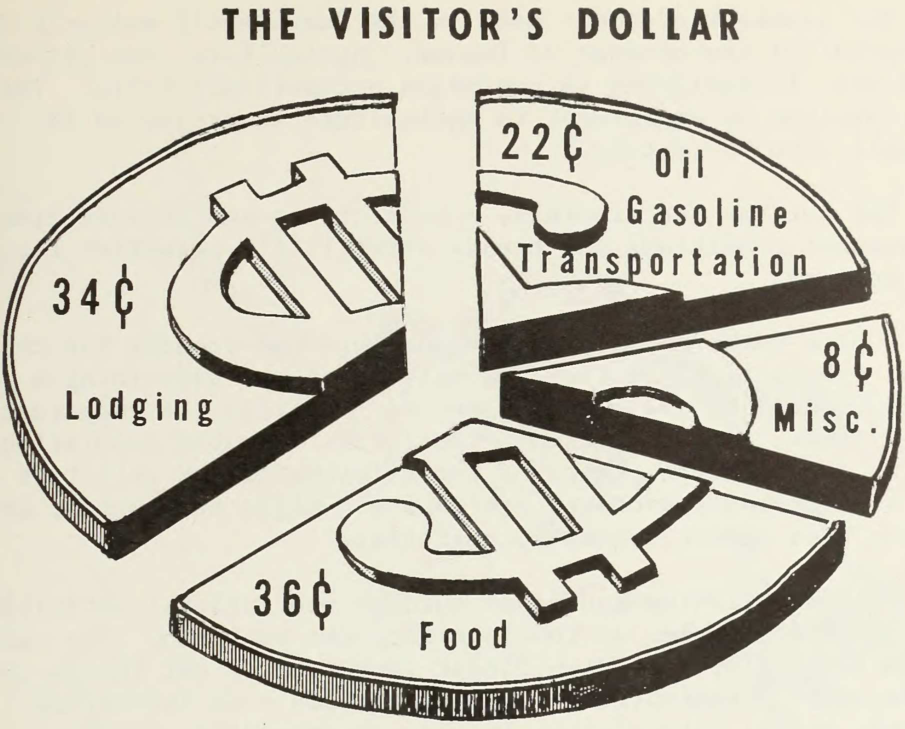


Figure 29

The public domain is increasingly important in sustaining and developing the subbasin's tourist-recreation industry. In 1965 approximately 18,500 daily visits were recorded on the public domain of the Musselshell subbasin.

Of the land-oriented recreation activities, hunting ranks number one on the public lands administered as part of the public domain. About 178,000 acres of the subbasin are key wildlife habitat.

Fishing and driving-sightseeing rank second and third of the activities enjoyed on public domain. Camping, picnicking and other intenseive uses take place in many areas lacking development such as the scenic land and water areas of the Missouri River between Fort Benton and Fort Peck Reservoir.

The Montana Travel Industry states that if a community can attract two dozen travelers a day throughout the year, it is economically comparable to adquiring a new manufacturing industry with an annual payroll of $100,000. By this standard, the estimated 1.5 million recreational visitor days generated an industry equivalent of $17 million from all public recreation areas in the subbasin in 1965.

Economic Outlook

The greatest economic need in the Musselshell subbasin is the development of new sources of income. Agriculture, the principal economic force, is declining as the major occupational field. The consistent decline of employment in agriculture is projected to continue well into the future.

The outlook for minerals, manufacturing and construction based on present conditions and trends offer little potential for an expanding economy.

Public works might inject vigor into the economy but the need is not substantial for creating major projects sustaining a large labor force. The major needs are for utilities, transportation, education systems, and recreational facilities. As the population decreases in the subbasin, costs of the existing or new utilities and community services will increase per capita. Major development in these fields thus appear doomed to resistance.

Hunting, fishing and other outdoor recreational activities bring an increasing number of tourists into the subbasin. The sale and service industries show significant increases in net income over the past decade. Urbanization of the population plus increasing tourist trade signal future gains in the non-commodity producing industries.

The general outlook for the area appears to be an economy basing itself less on agriculture, and more on non-farm industry, particularly sales and services.

By capitalizing on the scenic and recreational attributes of the subbasin, the income from tourism and recreation may be able to expand the economy against a declining population and limited resource base.

THE PUBLIC LANDS

Characteristics and Administration

Public lands totalling 890,000 acres are administered by the Bureau of Land Management in the Musselshell Subbasin. The uses and disposition of these lands are governed by the Taylor Grazing Act of June 28, 1934, (48 Stat. 1272; USC 315), as amended, and other applicable public land laws. A recent Federal law of special significance in administration of the public lands is the Multiple Use Management Act of September 19, 1964 (78 Stat. 986).

The public lands of the Musselshell area were originally added to the Federal estate as part of the Louisiana Purchase. They

LAND PATTERN

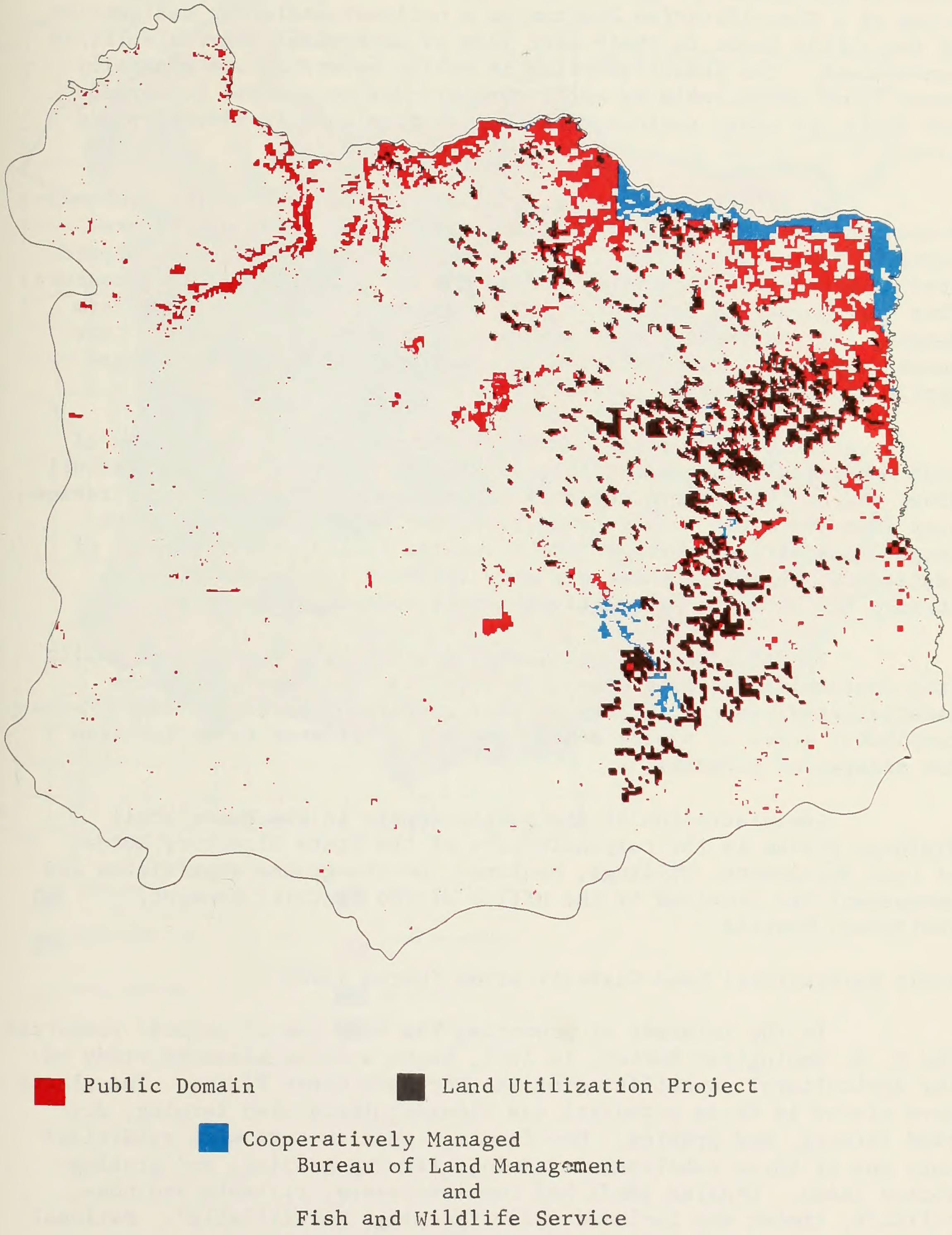

🟥 Public Domain
⬛ Land Utilization Project
🟦 Cooperatively Managed
Bureau of Land Management
and
Fish and Wildlife Service

Figure 30

have never been alienated to private use through operation of the public land laws, nor have they been withdrawn from entry for a specific management program. Since 1964 they have come within the scope of a Classification Program on a national scale for designation of the public lands to their best form of management under a multiple use concept. The lands remaining in public ownership are generally those found undesirable by early settlers due to adverse topography and soils, or other serious deficiencies from an agricultural standpoint.

An exception is found, however, in the case of the Bankhead-Jones Land Utilization lands. There are 353,000 acres which were formerly privately owned. They were marginal farmlands, used beyond their agricultural capability during the early decades of this century. They were purchased during the 1930's under the Bankhead-Jones Farm Tenancy Act, and have since been managed by a Federal agency. Laws governing use and disposition of the L.U. tracts differ from those applicable to the other public lands.

The 890,000 acres currently administered by the Bureau of Land Management are concentrated in a heavy margin along the Missouri River and in the eastern third of the subbasin. Another concentration runs from southwest to northeast along the Arrow River. A fourth large block extends through five townships in the area northeast of Lewistown. Elsewhere there are many isolated tracts scattered through the subbasin in relatively small individual parcels.

By definition of the Taylor Grazing Act, a parcel of public land containing not more than 1520 acres is "isolated", thus the name"isolated tract". Blocks of land containing more than 1520 contiguous acres of public domain are not considered to be isolated for management purposes.

Administration of the public domain in the Musselshell Drainage System is the responsibility of the State Director, Bureau of Land Management, Billings, Montana. On-the-ground supervision and management are provided by the Office of the District Manager, Lewistown, Montana.

Early Agricultural Land Classification (Circa 1924)

In the interest of promoting the best use of natural resources, the U. S. Geological Survey, in 1924, began a reconnaissance study of the agricultural capabilities of the Northern Great Plains. The plains were placed in three potential use classes; irrigation farming, dry-land farming, and grazing. Dry-farming lands in turn were subdivided into one of three subclasses; farming, farming-grazing, and grazing-forage lands. Grazing lands had two subclasses, tillable and non-tillable; timber was included under "grazing, non-tillable". National Forests and National Parks were not classified.

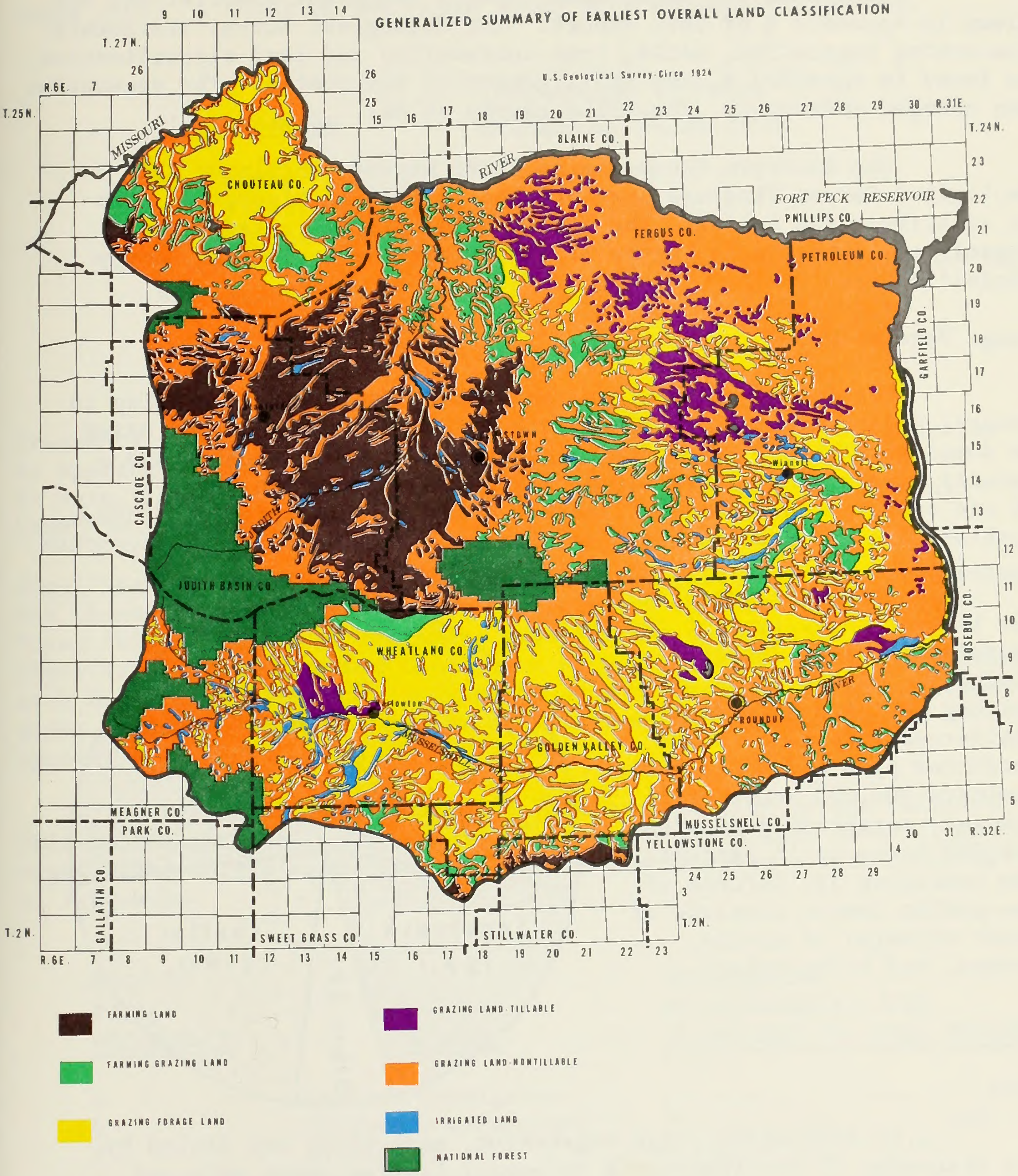

GENERALIZED SUMMARY OF EARLIEST OVERALL LAND CLASSIFICATION
U.S. Geological Survey-Circa 1924
T. 27 N.
T. 25 N.
T. 24 N.
T. 2 N.
R. 6 E.
R. 31 E.
R. 32 E.
MISSOURI
RIVER
CHOUTEAU CO.
BLAINE CO.
FORT PECK RESERVOIR
PHILLIPS CO.
FERGUS CO.
PETROLEUM CO.
GARFIELD CO.
CASCADE CO.
JUDITH BASIN CO.
WHEATLAND CO.
GOLDEN VALLEY CO.
ROSEBUD CO.
MUSSELSHELL CO.
YELLOWSTONE CO.
MEAGHER CO.
PARK CO.
GALLATIN CO.
SWEET GRASS CO.
STILLWATER CO.
STOWN
Winnett
Harlowton
ROUNDUP
MUSSELSHELL
RIVER
FARMING LAND
FARMING GRAZING LAND
GRAZING FORAGE LAND
GRAZING LAND-TILLABLE
GRAZING LAND-NONTILLABLE
IRRIGATED LAND
NATIONAL FOREST

Figure 31

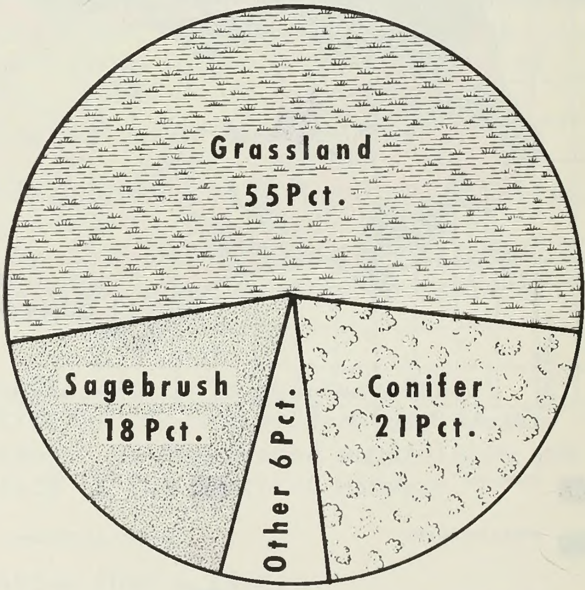
Standards for these land classes and plant associations are given in Appendix B of this report. The Geological Survey statements concerning vegetation, soils, crop suitability and land classification as found in Appendix B, are still generally applicable. The vegetation has changed moderately, the soils hardly at all.

The Northern Great Plains Study Report containing the Geological Survey Findings, was printed in 1929 in mimeograph form in relatively few copies. The accompanying map extracted for the Musselshell subbasin in Figure 31 summarizes the Geological Survey classification.

Range Vegetation

The Bureau of Land Management maps rangelands according to general vegetative aspect. There are 18 Standard Range Types based on dominant plants. (Appendix C) Range Types have a number and a general name such as 1-Grassland, 2-Meadow, 4-Sagebrush, etc.... If one aspect is dominant but another group of plants is conspicuous, combinations are used such as 1-4 grassland with conspicuous sagebrush.

Perennial grassland, the largest range type of the Musselshell River Subbasin, dominates 544,000 acres or 55 percent of the public domain. Coniferous forests of mixed ponderosa pine and Douglas-fir dominate 208,000 acres or 21 percent; sagebrush dominates 178,000 acres or 18 percent. The remaining six percent of the public domain consists of minor acreages of meadow, swamps, and rocky areas.



In evaluating range vegetation, each plant was listed by its frequency of occurrence. A frequency listing shows only one fact, that a plant occurs on a field inventory writeup sheet.

Some plants dominate the vegetation by sheer bulk of forage. This production is most significant in deciding their value in the grazing economy. Each plant was estimated as to the percentage it made up of the total vegetation. Fifteen percent of total forage was chosen as the break-off point for evaluating the relative importance of the individual species. Plants making up less than 15 percent were excluded as not significant.

Plant frequency and relative volume of production is illustrated in the following simplified forage description for one range site. A total of 644 range sites were carefully examined.

Plant Species	Percentage of Total Forage for Range Site
Blue grama	25%
Sand dropseed	10%
Western wheatgrass	5%
Prickly pear	T (Any amount less than 5%)
Big sagebrush	60%
Total	100%

Frequency: Each of the above plants has a frequency of one - because it appeared as one of the component species of this range site. If it were listed on every one of the 644 range site writeups it would have 100 percent frequency.

Significant production: Fifteen percent of the total forage production was chosen as the breaking point for relative importance of species. Using this criterion in the above example, the only plants with significant production are blue grama with 25 percent and big sagebrush with 60 percent. The total number of such occurrences in 644 writeups gives a useful figure for comparing relative importance, species by species.

Frequency and significant forage production seldom coincide. This is brought out in Figure 32, showing the ten plants with highest significant forage production as they rank with other plants in order of frequency.

RANK BY TOTAL OCCURRENCE	SPECIES	FREQUENCIES OF OCCURRENCES OVER 15 PERCENT OF TOTAL FORAGE
1	Western wheatgrass	......................49%
4	Bluebunch wheatgrass	....................36%
2	Blue grama	................25%
5	Needleandthread	..............20%
8	Big sagebrush	............14%
15	Idaho fescue	...........10%
11	Ponderosa pine	..........8%
9	Sandberg bluegrass	..........8%
10	Threadleaf sedge	..........8%
3	Prairie junegrass	.........6%

Figure 32

The principal forage grasses of the Musselshell River subbasin are western wheatgrass, bearded bluebunch wheatgrass, blue grama and needleandthread.

Blue grama is a short grass, productive and palatable. It begins growth in late April and cures in late July and August. In normally moist years it not only bears up well under heavy use but increases its area of distribution. Blue grama escapes some of the grazing pressure by its low growth habit. With excessive grazing pressure, taller grasses bear the heaviest utilization; as they weaken and disappear, blue grama will move into their former sites.

Western wheatgrass, bearded bluebunch wheatgrass, and needleandthread are mid-grasses. Their growth starts in late March or early April, and stops between late June and mid-August; growth resumes under the influence of fall rains, but with decreased vigor.

Sandberg bluegrass and prairie junegrass are examples of plants that are rejected by livestock. They are found on 94 out of every 100 range sites and they are abundant on 14 percent of the sites. Unfortunately, they are of little value to livestock, being short and unpalatable. They cannot be grazed much closer to the ground than their normal ungrazed height.

Threadleaf sedge and Idaho fescue both have early spring growth that is valuable for forage. Threadleaf sedge is drought resistant and its fairly low growth habit helps it to sustain heavy grazing.

Fringed sagebrush, big sagebrush, and silver sagebrush are key shrubs totaling 121 percent frequency; this means one or two of these species occur on every range site. The most productive shrub species is big sagebrush. On 14 percent of the range sites it produced 15 percent or more of total forage yield.

For eight months out of the year, antelope live principally on these three shrubs. Cattle and sheep use big sagebrush and silver sagebrush heavily during the winter. Silver sagebrush is grazed by cattle during the summer. Fringed sagebrush, although valuable to wildlife, is unpalatable to livestock and tends to increase on heavily grazed range. Big sagebrush and silver sagebrush decrease under light range use and increase under heavy use. However, the increase or decrease of these plants is related as much or more to weather cycles and the effect of soils, as to grazing pressures. None of the shrubs are a range plant problem and control measures are not needed.

Ponderosa pine and Douglas-fir are the principal timber species of the public domain. They are found on 53 percent of the sites and are important on 12 percent. They provide lumber for local building and repair.

Annual forb (weed) frequencies run high. The most common of these annual plants are phlox, 29 percent; western yarrow, 20 percent; and eriogonum, 10 percent. Oyster plant, curlycup gumweed, aster and goldenweed each have 8 percent frequencies. Arnica was the only forb found to contribute more than 15 percent forage and that happened on only one site.

Noxious plants and plants of low palatability are common. Fringed sagebrush and broom snakeweed are found on 75 percent of the range sites and prickly pear on 33 percent. Usually these noxious plants are in minor quantities, but on 2 percent of the sites, they form 15 percent of the vegetation. Cactus and yucca (16 percent frequency) are more often related to soil conditions than any other single environmental factor.

Poisonous plants are not a problem in the Musselshell River Subbasin. Cocklebur causes the most cattle losses, a few head die each year where cocklebur has established itself on raw soils such as fresh alluvium deposited by summer floods.

Black greasewood is the poisonous plant found in greatest quantity, but no losses are reported. Death camas and crazyweed are uncommon. Some potentially poisonous plants, especially lupine and chokecherry are commonly used by livestock and wildlife as forage. Lupine manufactures toxic alkaloids, but its toxicity varies seasonally; chokecherry is toxic only after a frost or severe drought.

Formerly, locoweed caused severe losses among work horses. However, with the great decline in numbers of horses and the virtual eradication of the plant, livestock death from locoweed is almost unknown.

Livestock poisoning from range plants is most likely to occur when the animals are very hungry, such as in the wake of a prolonged storm. During drought periods, a lack of desirable forage may force livestock to graze on unpalatable and even dangerous plants. The conditions which result in livestock poisoning are not normally encountered because of the quality range forage production and good livestock management systems.

Range Condition

A combination of weather and range management practices combine to determine range condition - the two work together to produce the subbasin's generally favorable range condition.

The most sensitive and accurate indicator of range condition is total plant cover. The original vegetative covering for each range site is first determined by studying protected or well-managed range lands. Current condition is then evaluated by comparing present vegetation with that originally occuping the site. (See Appendix C for details on range inventory method) Range condition is expressed as follows:

Excellent	75 to 100% of the original plant cover
Good	50 to 75 % of the original plant cover
Fair	25 to 50 % of the original plant cover
Poor	0 to 25 % of the original plant cover

A range site in "Excellent" condition has,essentially, its original plant cover. The next lower class, "Good", represents small changes in which some percentage of the original plants have been replaced. Lower condition groups, "Fair" and "Poor", represent greater departures from the original plant cover.

Typical "Excellent" and "Good" rangelands have more of the desirable grasses and forbs, greater forage production, and more soil cover of mulch and litter. These factors, however, will vary with the climate and range type. Rangeland in "Fair" and "Poor" condition has less forage production and many of the plants are unpalatable. It is important to note that condition is not directly related to forage production. Badlands can be in "Excellent" condition, but the total forage production is extremely low.

On "Fair" rangeland, the plants may be inferior to those of the original plant cover, but still furnish forage at a season of critical need. Therefore, areas in "Fair" condition may be highly useful in management of the range.

"Poor" condition is the lowest class. The original plant cover may be partly or completely replaced by other, often undesirable vegetation.

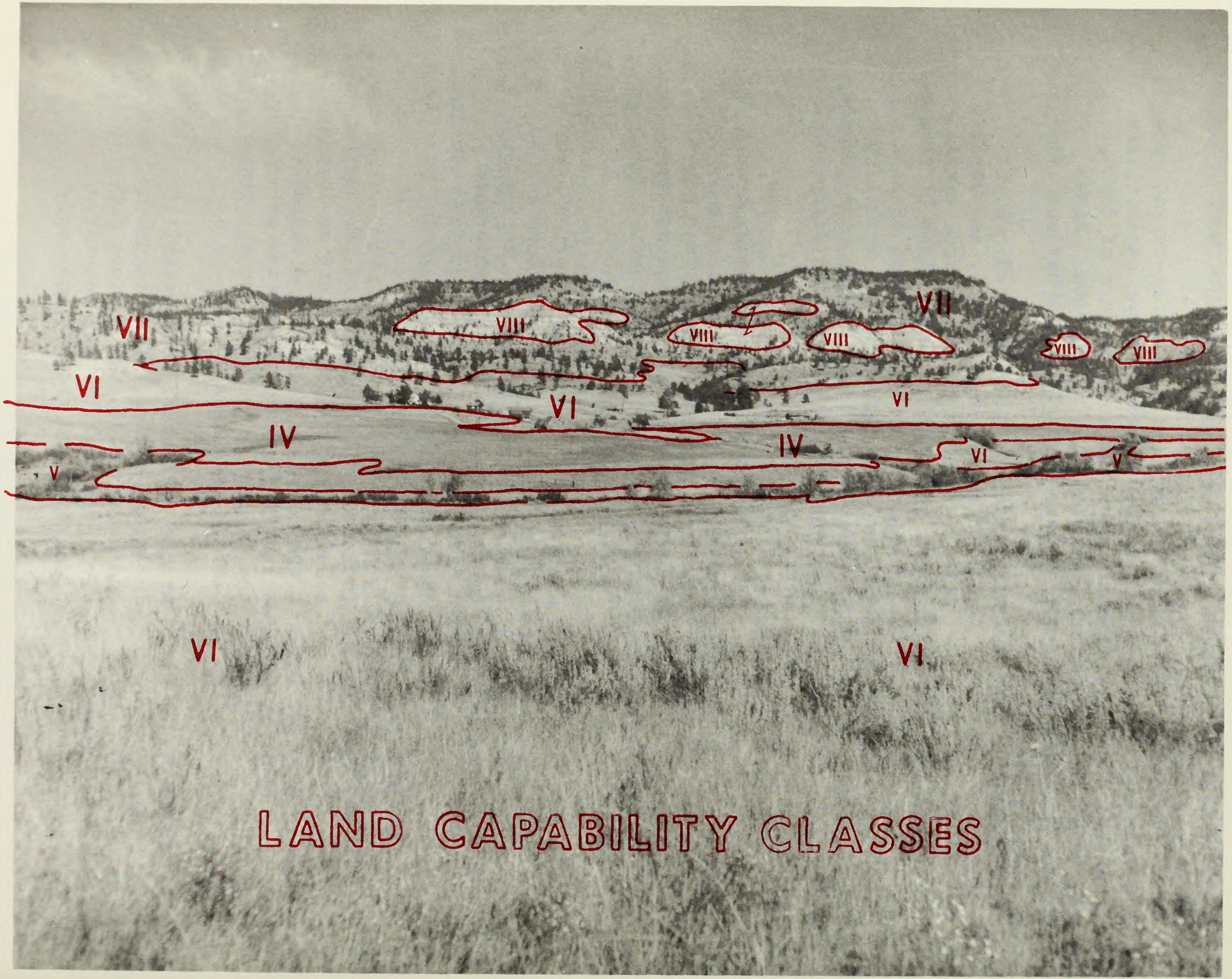
Field examination, as summarized in the following table, disclosed that 84 percent of the public domain is in "Good" or "Excellent" condition. Only 16 percent has changed substantially from the original plant cover species.

Excellent Condition	24 percent	122,900 acres
Good Condition	60 percent	310,900 acres
Fair Condition	15 percent	78,700 acres
Poor Condition	1 percent	3,200 acres

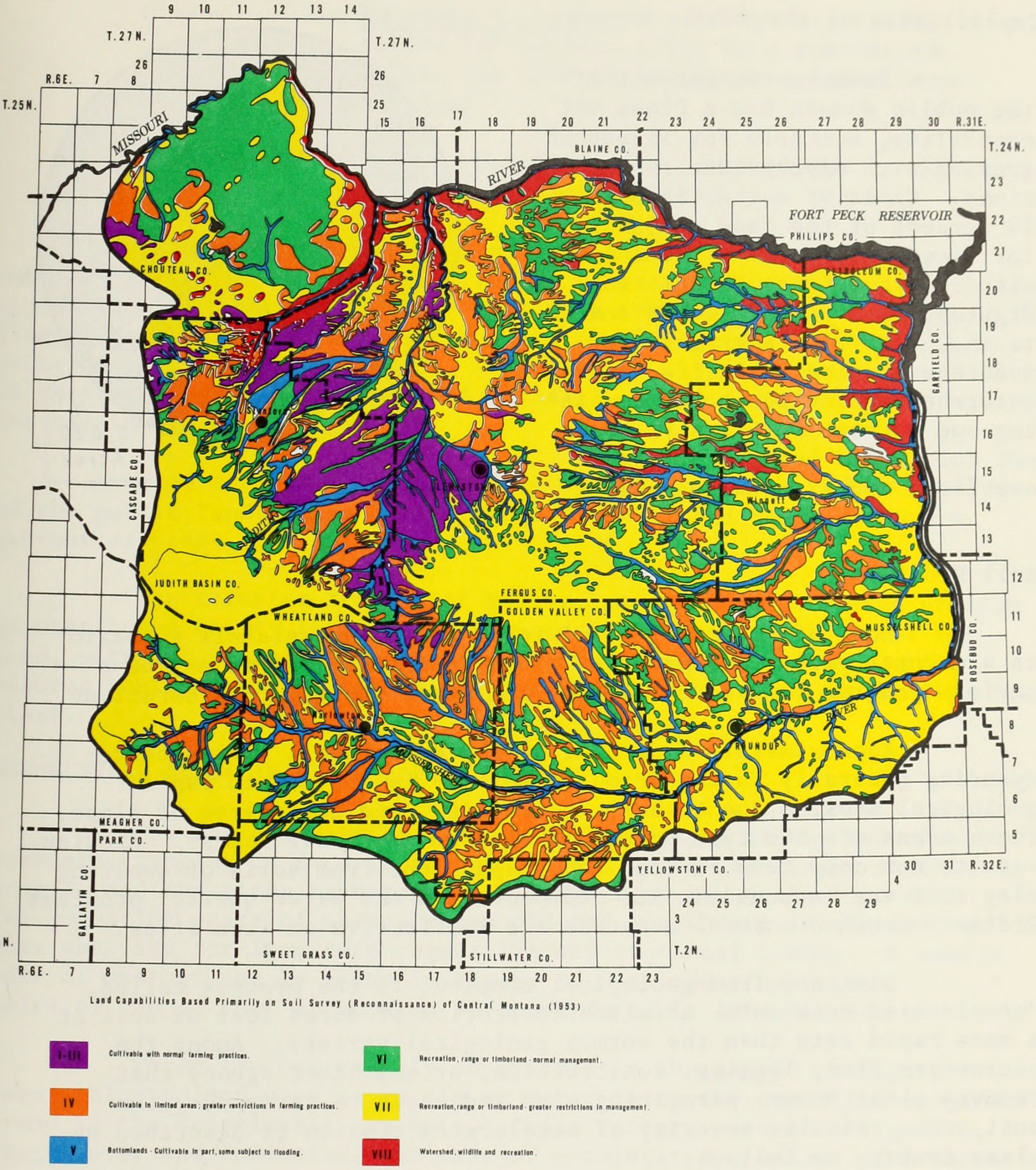
Land Capabilities and Classes

Land capabilities express the limits for long-range, safe, economic land use. Government agencies commonly group capabilities into eight broad classes determined by the soil factors of depth, texture, fertility, slope and susceptibility to erosion. These factors are balanced against long-term production without soil damage.

Classes I - IV	All lands can be cultivated. Soils deep to fairly deep, level, and fertile. Class I soils produce any crop within limits of local climate; Class II require moderate precaution to guard against soil erosion, and maintain fertility. The higher the class number, the greater the management problems and degree of precaution needed.
Class V	This class falls between major groups that can be cultivated, and those which must remain in permanent plant cover. These soils may be deep and nearly level, but cannot be cultivated due to flooding, rockiness, etc..
Class VI	Restricted to permanent, native plant cover. Finds its highest form of use in production of livestock forage and forage for wildlife, and watershed protection. For these uses, no restrictions other than good range management practices are needed.
Class VII	Includes soils with increasing use hazards resulting from such factors as increased slope, shallow profile and unstable texture. Restricted to lighter grazing, and greater care in management than Class VI is needed.
Class VIII	At the extreme of land capability. Includes marshes, steep rugged mountains, and barren badlands. Values for wildlife are often high, as are watershed protection and recreational use.



LAND CAPABILITY CLASSES

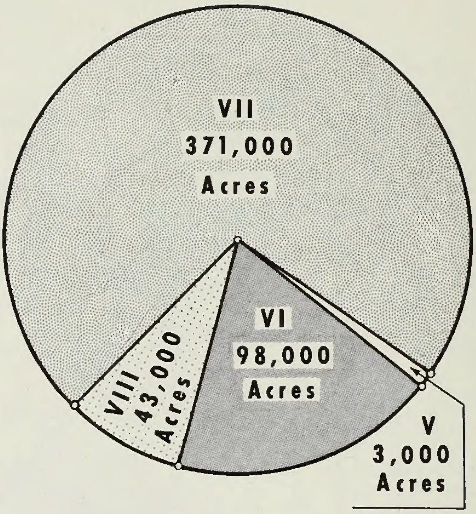


Land Capabilities Based Primarily on Soil Survey (Reconnaissance) of Central Montana (1953)

LAND CAPABILITIES

Figure 34

Capabilities of the Public Domain



Seventy-two percent of the public domain has a Class VII capability, suitable for livestock grazing with appropriate restrictions. Class VI soils, comprise 19 percent of the land, suitable for livestock or timber production without significant restriction. Eight percent of the public domain is in Class VIII, restricted to moderate grazing, wildlife, and watershed protection. The remaining one percent is Class V, areas not cultivated because of river overflow, rocks or saline soils.

Soil Erosion

Most of the erosion occurring in the Musselshell subbasin is a natural geological process. This is normal, but it may be a serious problem in land management and water quality considerations.

Approximately 5 percent of the Musselshell area - corresponding generally to the Grumosol soils - is subject to rapid geological erosion due to soil instability, and the degree of slope. These areas are the type sometimes classed as "frail lands". Erosion results not only from adverse topography, but from soils of swelling clay that are responsible for sedimentation and water quality problems. Ordinary erosion control measures are ineffective on such sites.

Distinct from geological erosion, is the process called "accelerated erosion". Accelerated erosion produces loss of soil at a more rapid rate than the normal geological variety. Among the causes are fire, logging, construction, or any other agency that removes plant cover, permitting wind and water to carry away the soil. The relative severity of accelerated erosion is described by class numbers as follows:

Class 1	None to slight Almost undetectable.
Class 2	Slight to moderate In mature soils, 3/4 of the "A" horizon gone; in structureless soils, top 3 to 4 inches gone; rills widespread; small gullies common.

Class 3	Moderate to severe In mature soils, the entire "A" horizon gone; in structureless soils, top five inches gone; gullies large and deep.
Class 4	Severe So severe as to change the landscape; many large, deep gullies.

Examination disclosed that public lands of the Musselshell subbasin suffer relatively minor losses to accelerated erosion. Approximately 79 percent of the lands were evaluated as being in the Class I Water erosion category meaning the damage was none to slight. Water erosion produced Class II, or slight to moderate damage, on 20 percent of the public land and Class III - moderate to severe on the remaining 1 percent.

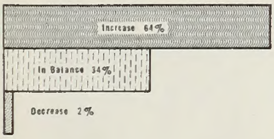
Wind erosion was found to be negligible, with 99 percent of the public lands being evaluated as Class I, and the remaining 1 percent as Class II.

The relative freedom of public lands from accelerated erosion is attributed mainly to (1) the predominantly rough character of the land, with its perennial vegetative cover, and (2) management which assures that use of the land will be limited to its land capability class.

MUSSELSHELL SUBBASIN PHOTOGRAPHIC STUDIES

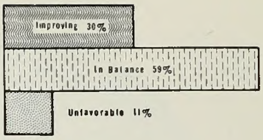
The field locations of 63 old photographs in the Musselshell subbasin, ranging in date from 1892 to 1930, were identified on the ground, and the sites rephotographed as part of the present study. The resulting pairs of photos - one old and one modern in each set - were analyzed for long-term vegetative and erosional trends. A sample pair of photographs is shown in Figure 35. An additional ten pairs of the 63 that were taken are reproduced in Appendix B.

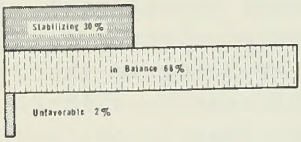
Three factors readily observable in the paired photographs were evaluated and used as an aid in determining the overall ecological trend in the Musselshell subbasin. These factors were timber growth, range cover and condition, and rate of accelerated erosion. The three individual factors were combined into a fourth, a summary of overall trend.



A definite expansion of timbered areas has taken place during the years between the early photographs and the present. In addition to normal tree growth, more than half of the photographs show an increase in both tree numbers and invasion of new locations. A climatic change is the probable cause for the increase and invasion of trees from established stands; other subbasins of the Missouri River Basin and in Alaska and Wisconsin demonstrate the same trend.

Vegetative ground cover has increased. This increase is reflected in a corresponding decrease in the rate of erosion.

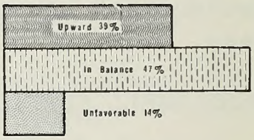




Gullies have stabilized and revegetated in 30 percent of the photographs; in only 2 percent is this condition growing worse.

"Overall" repeat photographs confirm a favorable subbasin-wide situation where "improvement" and "in balance" predominate. The 63 photographic stations used in the Musselshell show an upward or improving trend on 39 percent of the sites, a favorable stable situation where environmental factors are in balance on 47 percent, and an unfavorable trend on 14 percent.

The stabilizing of accelerated erosion, recovery of forage plants, and the improved range condition show that the effect of past deterioration of rangeland can be reversed.



As seen in Figures 35 and 36, photographs and maps can also verify change or stability of geographic features.

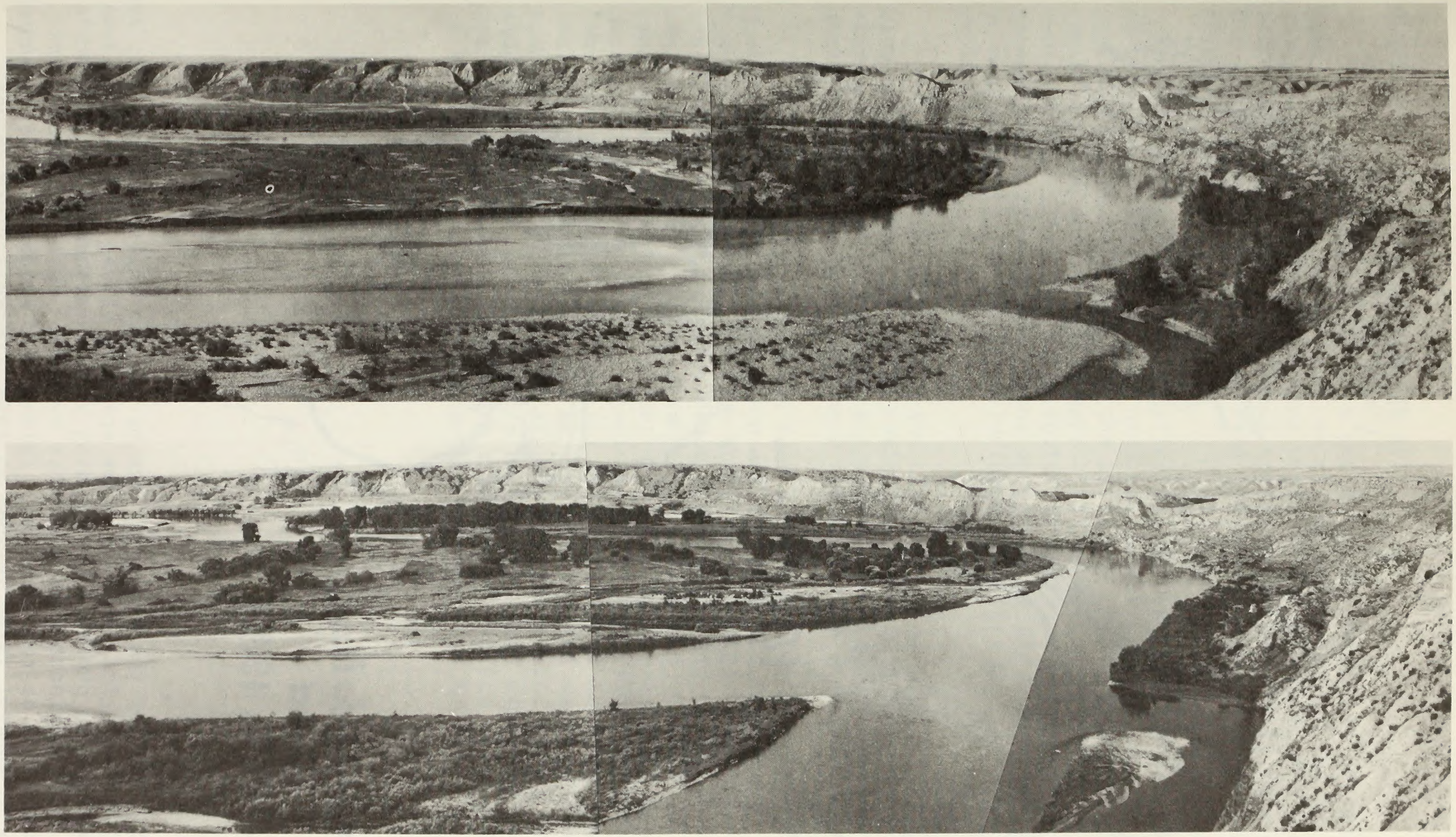


Figure 35. Top photo Pepperberg, USGS 1910. Bottom photo Burr, BLM 1967. Time span 57 years. Crocon du Nez bend of the Missouri River near Fort Benton, Montana. Island in the foreground of early picture now supports vegetation, but is being washed away by river action. The sandbar in foreground channel has moved west to join the bank, and shows signs of vegetating. Cottonwoods in the bend have increased in size and number. Islands and sandbars are migratory, but the river channel retains its essential shape.

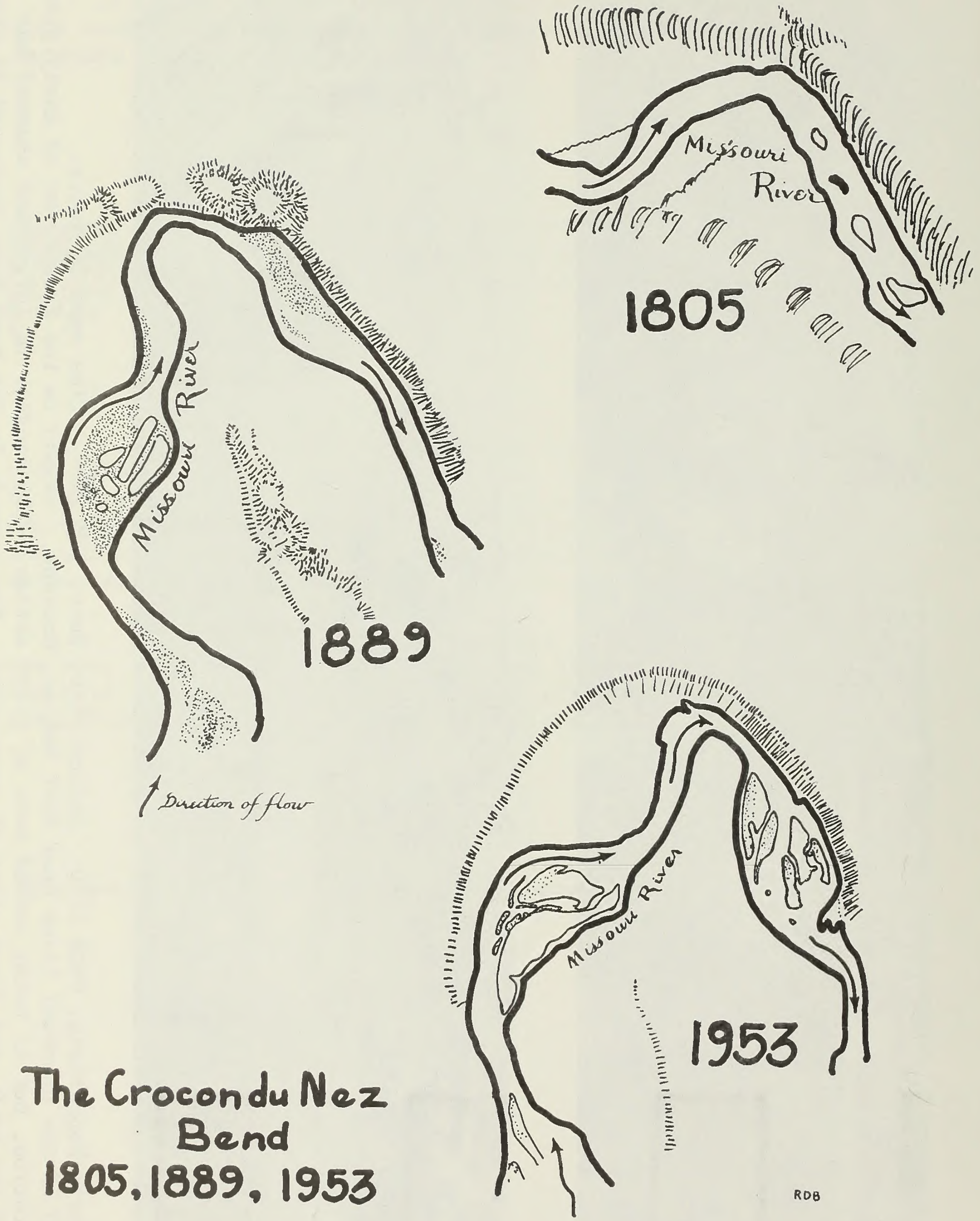


Figure 36. Maps of the Crocon du Nez by Captain William Clark, U.S. Army, and the U.S. Geological Survey. Time span 148 years. This is the same river bend seen in photos on preceeding page. Islands shown on Clark's 1805 map had deteriotated to a sandbar by 1889. By 1953 islands were again established at the location. Islands and sandbars in left channel had grown to several large islands by 1953. Overall river channel configuration has remained essentially the same since 1805.

CLASSIFICATION AND MULTIPLE USE ACT

By the Classification and Multiple Use Act of September 19, 1964, (PL 88-607), Congress directed the Department of The Interior, among other things, to determine which of the public domain lands were suitable for disposal, and which contained values making them suitable for retention in Federal ownership for management under principles stated in the Act.

The determinations called for by Congress are made as part of the regular-fund Bureau of Land Management program, under regulations approved by the Department of The Interior. These determinations are administrative actions which appear in final form as Federal Register publications. They are basic tools for use by the Bureau of Land Management in reaching decisions on petitions for change in ownership or management of the land, including suitability for transfer to another public agency.

Final actions under the Classification and Multiple Use Act have been completed for the Musselshell Subbasin. Following public hearings and other prescribed procedure, the classification determinations were announced as shown schematically in Figure 37.

Four categories have been provided under which lands may be designated in the classification and multiple use procedure. Category Number I provides for retention where well-blocked land patterns and other considerations clearly demonstrate that long term efficiency of administration will result. Number II is applied to areas of fragmented land pattern in which the objective is to improve management effectiveness. This may be done by consolidation of ownership, by retention of land, or by disposal. Number III is a restricted classification where management is planned for, or in cooperation with another Federal agency. Number IV designates areas where the public domain occurs as widely scattered isolated tracts or in areas near expanding communities. The majority of these tracts are regarded as subject to an orderly program of disposal, with interim management pending such action.

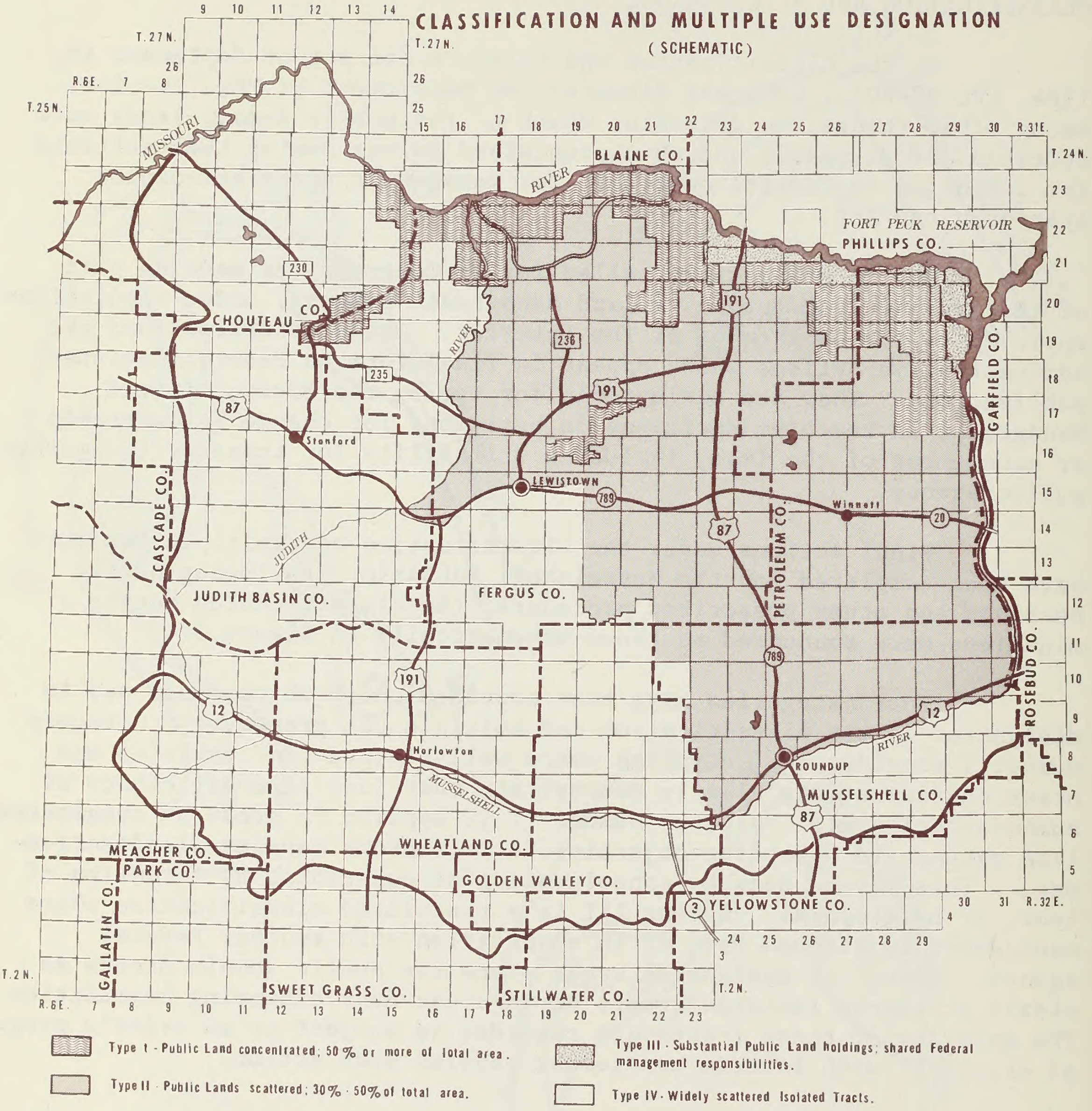

CLASSIFICATION AND MULTIPLE USE DESIGNATION
(SCHEMATIC)
MISSOURI
RIVER
FORT PECK RESERVOIR
PHILLIPS CO.
BLAINE CO.
CHOUTEAU CO.
CASCADE CO.
JUDITH BASIN CO.
FERGUS CO.
PETROLEUM CO.
GARFIELD CO.
ROSEBUD CO.
MUSSELSHELL CO.
WHEATLAND CO.
GOLDEN VALLEY CO.
YELLOWSTONE CO.
MEAGHER CO.
PARK CO.
GALLATIN CO.
SWEET GRASS CO.
STILLWATER CO.
JUDITH
MUSSELSHELL
Stanford
LEWISTOWN
Winnett
Harlowton
ROUNDUP
230
235
236
87
191
789
20
12
2
T.27N.
T.25N.
T.24N.
T.2N.
R.6E.
R.31E.
R.32E.
Type I - Public Land concentrated; 50 % or more of total area.
Type II - Public Lands scattered; 30% - 50% of total area.
Type III - Substantial Public Land holdings; shared Federal management responsibilities.
Type IV - Widely scattered Isolated Tracts.

Figure 37

RECOMMENDATIONS ON THE PUBLIC DOMAIN

In day-to-day Bureau of Land Management terminology the term "Land Classification" is used in the sense of approval for a change in ownership or management, including suitability for transfer to administration by another public agency. Classification of land within that context is made by an authorized officer of the Bureau of Land Management under authority of one of the public land laws.

In the present study, the participating personnel do not have authority to classify lands for a change in status, although their work incorporates important segments of the basic information found in formal classification reports. The term "classification", and its variations are thus used in this report within the limitation of classification in a technician's sense, rather than classification in an administrative sense.

Included in the 890,000 acres of Public Land inventoried in the Musselshell Subbasin, there were 659 individual parcels aggregating 60,600 acres, which occurred as isolated tracts. By definition of the Taylor Grazing Act, an isolated tract contains no more than 1,520 acres. Larger, contiguous parcels are not regarded as being isolated.

Of the isolated tracts, 30,500 acres in 259 parcels were considered to be best suited to retention in public ownership. The remaining isolated tracts were found to have characteristics normally favoring transfer out of public ownership in the interest of more efficient administration. These findings are reported, tract-by-tract, in Appendix A.

Twenty-one isolated tracts, comprising 1460 acres were transferred out of Federal ownership between the time of field examination and the writing of this report.

Individual areas exceeding 1,520 acres in size aggregate 576,000 acres in the Musselshell Subbasin. These lands were examined as part of the subject inventory, but they are not described individually in Appendix A as are the isolated tracts. The 353,000 acres of acquired Land Utilization lands were examined in the field, but they are not included in Appendix A.

Detailed narrative reports and maps of the isolated tracts described in Appendix A are on file in the BLM District Office at Lewistown, Montana, and at the Bureau's Denver Service Center.

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible] are not included in Appendix C.

[illegible] Appendix C [illegible]

APPENDIX A

Summaries of Isolated Tract Inventory

Appendix A - Description, classification of suitability, and proposed management of the public domain, by township and range, within the Isolated Tract Classification areas of the Musselshell River Area, Montana.

Introduction

The following information, in tabular form, summarizes inventory findings tract by tract. The public domain occurs in several land patterns. Where this pattern was one of a small acreage of public domain scattered through a predominantly private and state ownership, the land was inventoried and classed as isolated tracts. These findings, upon conclusion of the inventory, were forwarded to the appropriate District Office.

Of the 60,600 acres listed in the following tables, approximately 30,500 acres were evaluated as being best suited for retention and management in public ownership. Another 30,100 acres were considered best suited to disposal. Between the time of field inventory, and publication of this report, about 1,400 acres were disposed of pursuant to Land Classification programs of the agency.

Note: The material in the tables is self-explanatory with the exception of the numbers in the columns "Present Land Use" and "Principal Suitability". The numerals which denote this land use and suitability are: 1. Grazing: 2. Cropland: 3. Recreation: 4. Wildlife: 5. Mining: 6. Watershed: 7. Timber: 8. Human Occupancy and Industrial Development: 9. Access and Preservation of Public Values: 10. Submerged. "PSW" identifies a Power Site Withdrawal; "SDW" a Stock Driveway Withdrawal; "Rec" a Recreation Site Withdrawal; and "PWR" a Public Water Withdrawal.

Appendix A Continued

County	Twp	Range	Sec	Subdivision	Acres	General Land Character	AUMs	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
Sweetgrass	3N	18E	4	E½SE¼;SW¼SE¼	120.00	Mod. rolling grassland.	29	1	VII/120	1	Private
Golden Valley	4N	17E	26	NE¼NE¼	40.00	Strongly rolling grassland.	4	1-4	VII/40	1-4	Private
Stillwater	4N	19E	2	SE¼SW¼	40.00	Gently rolling to extremely steep.	2	1-6	VII/18;VIII/22	1-6	Private
Stillwater	4N	19E	6	Lots 4,5	60.64	Gently to mod. rolling grassland.	10	1-6	VI/61	1-6	Private
Stillwater	4N	19E	8	NW¼NW¼	40.00	Gentle to steep rolling grassland.	5	1-6	VI/21;VII/19	1-6	Private
Stillwater	4N	21E	2	Lot 4	10.85	Gentle to steep rolling grassland - conifer.	1	1-6	VII/7;VIII/4	1-6	Private
Stillwater	4N	21E	10	E½NE¼;SW¼NE¼;NW¼SE¼	160.00	Gentle to steep rolling grassland - conifer.	13	1-6	VII/93;VIII/67	1-6	Private
Stillwater	4N	21E	20	NE¼NE¼	40.00	Gentle to steep rolling grassland - conifer.	3	1-6	VII/18;VIII/22	1-6	Private
Stillwater	4N	22E	6	SE¼NE¼	40.00	Mod. to strongly rolling grassland range.	11	1-4-6	VI/28;VII/12	1-4-6	Private
Sweetgrass	5N	14E	8	SW¼SE¼	40.00	Steep rolling grassland.	9	1	VII/40	1	Private
Sweetgrass	5N	16E	8	Lots 1,4	80.75	Gently rolling grassland - conifer.	19	1-6	VII/80	1-6	Private
Sweetgrass	5N	16E	20	SW¼NE¼	40.00	Extremely steep sloping - timber.	7	1-6	VII/40	1-6	Private
Sweetgrass	5N	16E	30	NE¼;E½NW¼	240.00	Steep sloping mixed timber and grassland.	57	1-6	VII/240	1-6	Private
Golden Valley	5N	21E	24	S½SE¼	80.00	Mod. rolling grassland	19	1-4	VII/80	1-4	Private
Musselshell	5N	26E	4	SE¼NW¼	40.00	Steep sloping and very hilly conifer.	6	1-4	VII/29;VIII/11	1-4-6	Private
Musselshell	5N	26E	6	Lot 7;SE¼SW¼	80.23	Steep sloping and very hilly conifer.	7	1-4-6	VII/37;VIII/43	1-4-6	Private
Musselshell	5N	26E	6	E½SE¼	80.00	Steep sloping and very hilly conifer.	15	1-4-6	VII/54;VIII/26	1-4-6	Private
Musselshell	5N	26E	18	Lot 3;NE¼SW¼;N½SE¼	159.66	Steep to extremely steep conifer.	24	1-4-6	VII/125;VIII/35	1-4-6	Private
Musselshell	5N	26E	20	W½;SW¼SE¼	360.00	Steep to extremely steep conifer.	49	1-4-6	VII/258;VIII/102	1-4-6	Private
Meagher	6N	11E	8	SE¼SE¼	40.00	Steeply rolling conifer.	6	1-4-6	VIII/40	1-4-6	Private
Wheatland	6N	12E	6	Lot 5	40.26	Mod. to steeply rolling grassland.	18	1-4	VI/40	1-4	Private
Wheatland	6N	13E	2	SE¼SE¼	40.00	Mod. rolling grassland.	10	1-4	VI/40	1-4	Private
Wheatland	6N	13E	10	SW¼NW¼	40.00	Strongly rolling grassland.	8	1-4	VII/40	1-4	Private
Wheatland	6N	13E	10	NE¼NE¼	40.00	Steeply rolling grassland.	8	1-4	VII/40	1-4	Private
Wheatland	6N	13E	14	NE¼NW¼	40.00	Mod. rolling grassland.	8	1-4	VII/40	1-4	Private
Wheatland	6N	14E	22	S½SW¼	80.00	Gently to mod. rolling grassland.	27	1-4	IV/21;VI/59	1-4	Private
Wheatland	6N	15E	2	Lots 11,12	80.00	Gently rolling grassland.	17	1-4	VII/80	1-4	Private
Golden Valley	6N	19E	30	Lots 1,2;SE¼NW¼	116.72	Mod.rolling grassland	30	1-4	VII/117	1-4	Private

Appendix A Continued

County	Twp	Range	Sec	Subdivision	Acres	General Land Character	AUMs	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
Golden Valley	6N	19E	24	S½N½	160.00	Strongly rolling grassland.	26	1-4	VII/160	1-4	Private
Musselshell	6N	24E	30	Lot 1	39.07	Strong sloping and hilly - conifer.	10	1-6	VII/39	1-6	Private
Musselshell	6N	25E	8	E½NE¼;NE¼SE¼	120.00	Gently rolling to steep sloping grassland	33	1-6	VI/9;VII/111	1-6	~~Public~~ SOLD
Musselshell	6N	25E	8	SE¼SW¼;SW¼SE¼	80.00	Gently rolling to steep conifer.	22	1-6	VI/9;VII/71	1-4-6	~~Public~~ SOLD
Musselshell	6N	25E	10	S½SE¼	80.00	Steep sloping to very hilly conifer.	19	1-6	VII/80	1-6-7	Private
Musselshell	6N	25E	20	E½NE¼	80.00	Steep sloping to very hilly conifer.	21	1-4-6	VII/80	1-4-6	~~Private~~ SOLD
Musselshell	6N	26E	2	Lots 1,2,8,9	120.91	Strong sloping to hilly conifer.	32	1-6	VII/121	1-6	Private
Musselshell	6N	26E	2	Lots 5,12;NW¼SW¼	120.00	Steep sloping to very hilly conifer.	34	1-6	VII/120	1-6	Private
Musselshell	6N	26E	12	NW¼SW¼;S½SW¼	120.00	Strong sloping to hilly conifer.	42	1-6	VII/120	1-6	Private
Musselshell	6N	26E	12	Lot 4	33.96	Strong sloping to hilly conifer.	12	1-6	VII/34	1-6	Private
Musselshell	6N	27E	8	N½	320.00	Steep sloping and very hilly conifer.	97	1-6	VII/320	1-5-6	Private
Musselshell	6N	27E	10	N½NW¼	80.00	Strong sloping and hilly conifer.	22	1-6	VII/80	1-5-6	Private
Musselshell	6N	27E	10	S½S½;NW¼SW¼;NW¼SE¼	240.00	Steep sloping and very hilly conifer.	86	1-6	VII/240	1-5-6	Private
Musselshell	6N	28E	8	NW¼NW¼	40.00	Strong sloping and hilly conifer.	14	1-6	VII/40	1-5-6	Private
Meagher	7N	9E	2	W½SW¼	80.00	Strongly rolling grassland.	18	1-4-6	VII/80	1-4-6	Private
Meagher	7N	9E	32	NE¼NW¼;NW¼NE¼	80.00	Mod. rolling grassland.	22	1-4-6	VII/80	1-4-6	Private
Meagher	7N	11E	6	Lot 7	37.09	Mod. rolling grassland.	6	1-4-9	VII/37	1-4-9	Public
Meagher	7N	11E	14	NW¼NW¼	40.00	Nearly level to gently rolling grassland.	12	1-4-6	V/11;VII/29	1-4-6	Private
Meagher	7N	11E	14	S½NE¼	80.00	Steeply rolling grassland.	19	1-4-6	VI/80	1-4-6	Private
Wheatland	7N	13E	4	SE¼SE¼	40.00	Strongly rolling grassland.	8	1-4	VII/40	1-4	Private
Wheatland	7N	13E	4	SE¼SW¼	40.00	Mod. rolling grassland.	11	1-4	VII/40	1-4	Private
Wheatland	7N	13E	8	S½SE¼	80.00	Strongly rolling grassland.	24	1-4-9	VII/80	1-4-9	Public
Wheatland	7N	14E	2	Lots 3,4; SW¼NW¼	121.66	Strongly rolling grassland.	29	1-4	VII/122	1-4	Private
Wheatland	7N	14E	2	SW¼SW¼	40.00	Mod. rolling grassland	9	1-4	VII/40	1-4	Private
Wheatland	7N	14E	24	SW¼SW¼	40.00	Strongly rolling grassland	10	1-4	VII/40	1-4	Private
Wheatland	7N	14E	30	N½NE¼	80.00	Strongly rolling grassland.	14	1-4	VII/80	1-4	Private
Golden Valley	7N	22E	18	E½SW¼	80.00	Mod. to steep rolling grassland and waste.	10	1-4	VI/80	1-4	Private
Golden Valley	7N	22E	22	N½NE¼;SE¼NE¼	120.00	Mod. rolling grassland.	21	1-4	VI/120	1-4	Private

Appendix A Continued

County	Twp	Range	Sec	Subdivision	Acres	General Land Character	AUMs	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
Golden Valley	7N	23E	6	Lots 1,2	79.70	Mod. rolling grassland	27	1-4	VI/80	1-4	Private
Musselshell	7N	24E	26	SE¼NW¼;NE¼SW¼	80.00	Strong sloping and hilly conifer.	21	1-6	VII/80	1-6	Private
Musselshell	7N	24E	32	S½SE¼	80.00	Gently rolling to mod. sloping grassland.	16	1-6	VI/80	1-6-9	Public
Musselshell	7N	24E	34	NW¼NW¼	40.00	Gently rolling to mod. sloping grassland	10	1-6	VI/40	1-6	Private
Musselshell	7N	25E	4	SE¼NE¼;NE¼SE¼	80.00	Steep sloping and very hilly conifer.	22	1-6	VII/80	1-3-6	Public
Musselshell	7N	25E	10	NW¼	160.00	Steep sloping and very hilly conifer.	43	1-6	VII/160	1-6	Private
Musselshell	7N	26E	22	N½NE¼	80.00	Strong sloping and hilly conifer.	29	1-6	VII/80	1-6	Public
Musselshell	7N	26E	22	SW¼;S½SE¼	240.00	Strong sloping and hilly conifer.	73	1-6	VII/240	1-6	Public
Musselshell	7N	26E	34	N½NW¼	80.00	Steep sloping and very hilly conifer.	24	1-6	VII/80	1-6	Private
Musselshell	7N	26E	34	S½SW¼	80.00	Strong sloping and hilly conifer.	26	1-6	VII/80	1-3-6	Public
Musselshell	7N	27E	2	Lots 1-4	205.48	Steep sloping and very hilly conifer.	73	1-4-6	VII/205	1-3-4-6	Public
Musselshell	7N	27E	6	Lots 1,2,3,8	172.96	Strong sloping and hilly conifer.	52	1-6	VII/173	1-6	Private
Musselshell	7N	27E	6	Lot 11	40.00	Steep sloping and very hilly conifer.	12	1-6	VII/40	1-6	Private
Musselshell	7N	27E	10	SW¼SE¼	40.00	Strong sloping and hilly conifer.	14	1-6	VII/40	1-6	Public
Musselshell	7N	27E	18	Lot 4	49.03	Strong sloping and hilly grassland.	15	1-6	VII/49	1-6	Private
Musselshell	7N	27E	22	N½NE¼	80.00	Gently rolling to strong sloping conifer-grassland.	26	1-6	V/11;VII/69	1-6	Private
Musselshell	7N	27E	34	NW¼SW¼;N½NW¼;SW¼NW¼	160.00	Strong sloping and hilly conifer.	55	1-6	VII/160	1-6	Private
Musselshell	7N	28E	8	E½E½	160.00	Steep sloping and very hilly conifer.	59	1-6	VII/160	1-6	Private
Musselshell	7N	28E	18	Lot 1;NE¼NW¼	80.59	Steep sloping and very hilly conifer.	16	1-6	VII/61;VIII/20	1-6	Private
Musselshell	7N	28E	20	SW¼SW¼	40.00	Steep sloping and very hilly conifer.	14	1-6	VII/40	1-6	Private
Meagher	8N	10E	5	Lots 1,2,5;SW¼NE¼	170.58	Very steep rolling grassland and conifer.	26	1-4-6	VII/144;VIII/27	1-3-4-6	Public
Meagher	8N	10E	6	Lot 1;SE¼NE¼	77.41	Very steep rolling grassland and conifer.	10	1-4-6	VII/55;VIII/22	1-3-4-6	Public
Meagher	8N	10E	6	Lots 3,4	78.34	Strongly to steeply rolling grassland and conifer.	17	1-4-6	VII/68;VIII/10	1-3-4-6	Public
Meagher	8N	10E	12	SE¼SW¼	40.00	Steeply rolling grassland.	8	1-4-6	VII/40	1-4-6	Private
Meagher	8N	10E	24	S½NW¼;NW¼SW¼	120.00	Steeply rolling grassland.	19	1-4-6	VII/120	1-4-6	Public
Meagher	8N	10E	24	NE¼NE¼	40.00	Nearly level to gently rolling grassland & waste	18	1-4-6	VII/22;VIII/18	1-3-4-6	Public
Wheatland	8N	17E	4	NW¼SE¼	40.00	Gently rolling grassland.	7	1-4	VII/40	1-4	Private
Golden Valley	8N	19E	6	Lots 4,5;SE¼NW¼;SW¼NE¼	154.34	Gently to mod. rolling sagebrush.	30	1-4	VI/44;VII/110	1-4	Private

Appendix A Continued

County	Twp	Range	Sec	Subdivision	Acres	General Land Character	AUMs	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
Golden Valley	8N	20E	30	Lot 2;SE¼NW¼;S½NE¼;NE¼SE¼	195.59	Mod. rolling sagebrush	47	1-4	VII/196	1-4	Private
Golden Valley	8N	22E	14	NW¼NW¼	40.00	Mod. rolling grassland	7	1-4	VII/40	1-4	Private
Golden Valley	8N	22E	18	SE¼NW¼;NW¼SE¼	80.00	Mod. rolling grassland	21	1-4	VII/80	1-4	Private
Musselshell	8N	23E	4	Lot 4	35.49	Strong sloping to hilly sagebrush.	9	1-6	VII/35	1-6	Private
Musselshell	8N	23E	14	SE¼NE¼	40.00	Gently rolling,strong sloping sagebrush - grassland.	5	1-6	VI/4;VII/36	1-6	Private
Musselshell	8N	26E	4	SE¼NW¼	40.00	Level to steep grassland	8	1-6	VII/40	1-6	Public
Musselshell	8N	26E	26	W½NE¼	80.00	Mod. to steep sloping grassland.	14	1-6	VII/80	1-6	Private
Musselshell	8N	27E	2	E½;Lot 6;S½NE¼;NW¼SE¼	160.00	Steep sloping and very hilly grassland.	43	1-6	IV/50;VII/93; VIII/17	1-3-4-6	Public
Musselshell	8N	27E	20	NE¼SE¼	40.00	Strong sloping and hilly conifer.	13	1-6	VII/40	1-6	Private
Musselshell	8N	27E	22	SW¼NW¼;N½SW¼;NW¼SE¼	160.00	Strong sloping and hilly conifer.	55	1-6	VII/160	1-6	Private
Musselshell	8N	27E	32	E½NE¼;NW¼NE¼;N½SE¼;N½NW¼; SW¼NW¼	320.00	Strong sloping and hilly conifer.	98	1-6	VII/320	1-6	Private
Musselshell	8N	28E	2	Lots 4,5,12.	120.99	Gently rolling to steep sloping conifer & grassland	34	1-4-6	VI/105;VII/16	1-4-6	Private
Musselshell	8N	28E	2	S½S½;NW¼SW¼	200.00	Strong sloping and hilly grassland.	55	1-6	VI/200	1-6	Public
Musselshell	8N	28E	4	Lot 1	39.39	Strong sloping and hilly conifer.	13	1-6	VII/39	1-6	Private
Musselshell	8N	28E	4	Lot 16	40.00	Strong sloping and hilly conifer.	14	1-6	VII/40	1-6	Private
Musselshell	8N	28E	12	NW¼NW¼	40.00	Strong sloping and hilly grassland.	11	1-6	VI/40	1-6	Public
Musselshell	8N	28E	12	NE¼SE¼	40.00	Steep sloping and very hilly grassland.	11	1-6	VI/40	1-6	Private
Musselshell	8N	28E	14	E½E½	160.00	Gently to mod. rolling conifer.	55	1-6	VI/160	1-6	Private
Musselshell	8N	28E	14	SW¼NW¼;W½SW¼;SE¼SW¼	160.00	Strong sloping and hilly conifer.	52	1-6	VII/160	1-6	Private
Musselshell	8N	28E	20	S½NW¼;NW¼SW¼	120.00	Strong sloping and hilly conifer.	32	1-6	VI/120	1-6	Private
Musselshell	8N	28E	28	N½;N½S½	480.00	Strong sloping and hilly conifer.	99	1-4-6	VII/299;VIII/181	1-3-4-6	Public
Musselshell	8N	29E	2	Lots 9,10	80.00	Gently to mod. rolling grassland.	29	1-6	VII/80	1-6	Private
Musselshell	8N	29E	6	Lot 13	40.00	Steep sloping and very hilly grassland.	11	1-6	VII/40	1-6	Private
Musselshell	8N	29E	22	E½E½	160.00	Steep sloping and very hilly conifer.	52	1-6	VII/160	1-6	Private
Musselshell	8N	30E	6	Lot 18	40.00	Strong sloping and hilly grassland.	14	1-6	VI/40	1-6	Private
Musselshell	8N	30E	26	NE¼NE¼	40.00	Steep sloping and very hilly conifer.	14	1-6	VII/40	1-6	Private
Meagher	9N	9E	14	SW¼NE¼	40.00	Strongly rolling grassland and conifer.	5	1-4-6	VII/40	1-4-6	Private

Appendix A Continued

County	Twp	Range	Sec	Subdivision	Acres	General Land Character	AUMs	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
Meagher	9N	10E	2	Lots 2,3;S½NW¼;NW¼SW¼		Strongly to steeply rolling					
				SW¼NE¼	240.00	grassland and conifer.	19	1-4-6	VII/240	1-4-6-7	Public
Meagher	9N	10E	3	Lot 1	40.06	Strongly rolling grassland.	12	1-4-6	VIII/40	1-4-6-7	Public
Meagher	9N	10E	3	W½SW¼	80.00	Mod. to strongly rolling grassland and conifer.	15	1-4-6-9	VII/80	1-4-6-9	Public
Meagher	9N	10E	8	Lot 1;NW¼NE¼;NE¼NW¼	114.06	Steeply rolling grassland and conifer.	2	1-4-6	VII/114	1-4-6	Private
Meagher	9N	10E	8	NW¼NW¼	40.00	Steeply rolling grassland and conifer.	4	1-4-6	VII/40	1-3-4-6	Public
Meagher	9N	10E	17	NW¼SE¼	40.00	Strongly rolling grassland.	11	1-4	VII/40	1-4	Private
Meagher	9N	10E	20	SW¼SW¼	40.00	Mod.rolling grassland and timber.	20	1-4-6	VII/40	1-4-6	Public
Meagher	9N	10E	20	SE¼NE¼	40.00	Mod. rolling grassland.	9	1-4	VII/40	1-4	Private
Meagher	9N	10E	21	SW¼NW¼	40.00	Mod. rolling grassland.	9	1-4	VII/40	1-4	Private
Meagher	9N	11E	8	SE¼SE¼	40.00	Gently to mod. rolling grassland.	12	1-4	VI/40	1-4	Public
Musselshell	9N	24E	22	Lot 5	17.59	Gently undulating grassland.	5	1-3-4-6-9	V/18	1-3-4-6-9	Public
Musselshell	9N	27E	20	SE¼SE¼	40.00	Gently rolling grassland & steeply rolling woodland.	9	1-6	VII/40	1-6-9	Public
Musselshell	9N	28E	26	NE¼NW¼	40.00	Gently to mod. rolling grassland.	8	1-4-6	VI/36;VIII/4	1-4-6	Private
Musselshell	9N	28E	34	SW¼SW¼	40.00	Steep sloping conifer	7	1-4-6	VII/40	1-4-6	Private
Musselshell	9N	29E	24	NE¼	160.00	Gently to mod. rolling grassland.	55	1-6	VII/160	1-6	Private
Musselshell	9N	30E	30	SE¼NW¼	40.00	Gently to mod. rolling grassland.	11	1-6	VII/40	1-6	Private
Musselshell	9N	31E	10	SE¼NW¼	40.00	Gently rolling grassland	6	1-6	VI/40	1-6	Private
Musselshell	9N	31E	20	Lot 1;SE¼NE¼	64.61	Steeply rolling grassland.	11	1-6	VII/65	1-3-6-9	Public
Meagher	10N	9E	4	Lot 1;SE¼NE¼	82.10	Very steep conifer	0	6-9	VIII/82	3-6-7-9	Public
Meagher	10N	9E	19	Lot 5	39.34	Mod. rolling grassland.	7	1-5	VII/39	1-3-5	Public
Meagher	10N	9E	28	Lots 3-7	50.95	Mod. rolling grassland.	11	1-5	VII/51	1-3-5	Public
Meagher	10N	9E	29	Lots 3-6,11,12;SW¼NW¼;							
				NW¼SE¼;NW¼SW¼	240.79	Mod. rolling grassland.	50	1-5	VII/241	1-3-5	Public
Meagher	10N	11E	14	NE¼SW¼	40.00	Mod. rolling grassland	15	1-4-6	VI/40	1-4-6	Public
Meagher	10N	11E	20	NW¼NE¼	40.00	Mod. to strongly rolling grassland.	14	1-4-6-7	VI/25;VII/15	1-4-6-7	Public
Meagher	10N	11E	21	Lots 1,5	8.00	Mod. rolling grassland	3	1-3-4-8	VI/8	1-3-4-8	Private
Meagher	10N	11E	21	Lot 6	9.02	Nearly level to mod. rolling grassland	3	1-4-6	VI/9	1-4-6	Private

Appendix A Continued

County	Twp	Range	Sec	Subdivision	Acres	General Land Character	AUMs	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
Meagher	10N	11E	21	Lot 2	26.20	Gently to mod. rolling grassland.	9	1-4-6	VI/26	1-4-6	Public
Meagher	10N	11E	21	Lots 4,9,10,11	10.97	Gently to strongly rolling grassland.	4	1-4-6	VI/11	1-4-6	Private
Meagher	10N	11E	22	Lots 1-4	47.15	Gently to mod. rolling grassland.	14	1-4-6	VI/47	1-4-6	Private
Meagher	10N	11E	23	Lots 3,9	9.78	Gently rolling grassland.	3	1-4-6	VI/10	1-4-6	Private
Meagher	10N	11E	28	Lot 6	1.74	Nearly level to gently rolling grassland.	1	1-4-6	VI/2	1-4-6	Private
Meagher	10N	11E	28	Lot 4	1.92	Gently rolling grassland.	1	1-4-6	VI/2	1-4-6	Private
Meagher	10N	11E	29	SW¼SW¼	40.00	Gently to strongly rolling grassland.	10	1-4-6	VI/40	1-4-6	Public
Meagher	10N	11E	31	SE¼SE¼	40.00	Gently to strongly rolling grassland.	12	1-4-6	VI/40	1-4-6	Public
Meagher	10N	11E	32	SW¼SW¼	40.00	Gently to strongly rolling grassland.	12	1-4-6	VI/40	1-4-6	Public
Meagher	10N	11E	33	SE¼SW¼	40.00	Gently to strongly rolling grassland.	15	1-4-6	VI/40	1-4-6	Public
Wheatland	10N	12E	32	NE¼	160.00	Gently to strongly rolling grassland.	38	1-4	VI/160	1-4	Public
Wheatland	10N	13E	18	Lot 4	2.45	Mod. rolling grassland.	1	1-4	VII/2	1-4	Private
Wheatland	10N	13E	21	Lot 7	2.92	Nearly level grassland.	1	1-4	V/3	1-4	Private
Wheatland	10N	13E	25	Lots 1-3	9.60	Mod. rolling grassland.	3	1-4	VI/10	1-4	Private
Wheatland	10N	13E	26	Lots 1,2	8.16	Mod. rolling grassland.	3	1-4	VI/8	1-4	Private
Wheatland	10N	13E	27	Lots 4-7	8.05	Nearly level grassland	3	1-4	V/8	1-4	Private
Wheatland	10N	13E	30	Lot 2	.08	Strongly rolling grassland.	0	1-4	0	1-4	Private
Wheatland	10N	13E	31	Lots 8,9	7.44	Strongly rolling grassland.	2	1-4	VII/7	1-4	Private
Wheatland	10N	13E	34	Lots 5-9	13.48	Gently rolling grassland.	4	1-4	VI/13	1-4	Private
Wheatland	10N	14E	6	Lot 2;SW¼NE¼	79.07	Mod. rolling grassland.	4	1-4-6	VII/79	1-4-6	Private
Wheatland	10N	14E	22	N½NW¼	80.00	Gently to strongly rolling grassland.	22	1-4	VI/80	1-4	Public
Wheatland	10N	14E	26	E½NW¼;NW¼NE¼	120.00	Gently to mod. rolling grassland.	32	1-4	VI/120	1-4	Public
Wheatland	10N	15E	8	SW¼SW¼	40.00	Gently to mod. rolling grassland.	9	1-4	VI/40	1-4	Public
Wheatland	10N	17E	34	SE¼SW¼	40.00	Gently rolling grassland.	11	1-4	VI/40	1-4	Private
Musselshell	10N	22E	3	SE¼NW¼	40.00	Mod. rolling grassland.	8	1-6	VII/40	1-6	Private
Musselshell	10N	22E	18	E½E½	160.00	Nearly level grassland range	10	1-6	VII/160	1-6	Private
Musselshell	10N	27E	2	S½SE¼;NE¼SE¼	120.00	Gently undulating to steep sloping sage-greasewood	24	1-6	V/58;VII/62	1-6	Private
Musselshell	10N	27E	4	All	667.96	Gently to mod. rolling sage.	123	1-3-4-6	VI/668	1-3-4-6	Public

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County	Twp	Range	Sec	Subdivision	Acres	General Land Character	AUMs	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
Musselshell	10N	27E	6	Lot 1;SE¼NE¼	82.71	Gently to mod. rolling sage.	18	1-6	VI/83	1-6	Private
Musselshell	10N	27E	6	Lots 4,5	96.49	Gently to mod. rolling sage.	21	1-6-9	VI/96	1-6-9	Public
Musselshell	10N	27E	8	All but SW¼	480.00	Gently undulating sage.	92	1-4-6-9	VI/256;VII/221; VIII/3	1-4-6-9	Public
Musselshell	10N	27E	12	NW¼NE¼;W½W½;NE¼NW¼	240.00	Gently to mod. rolling sage.	43	1-6	VI/240	1-6	Private
Musselshell	10N	27E	12	Lot 4;SW¼SE¼	87.30	Gently to mod. rolling sage.	15	1-6	VI/87	1-6	Private
Musselshell	10N	27E	14	SW¼SW¼	40.00	Level to nearly level greasewood.	9	1-6	VII/40	1-6	Private
Muselshell	10N	27E	24	SE¼SW¼	40.00	Gently to mod. rolling sage.	7	1-6	VII/40	1-6	Private
Musselshell	10N	28E	14	S½SE¼	80.00	Gently undulating sage.	18	1-6	V/80	1-6	Private
Musselshell	10N	29E	12	N½NW¼	80.00	Gently to mod. rolling grassland.	17	1-6	VI/80	1-6	Private
Musselshell	10N	30E	30	NE¼NE¼	40.00	Gently to mod. rolling grassland.	6	1-6	VI/40	1-6	Private
Musselshell	10N	30E	30	NW¼SE¼	40.00	Gently to mod. rolling grassland.	6	1-6	VI/40	1-6	Private
Musselshell	10N	30E	34	N½S½	160.00	Gently to mod. rolling sage.	17	1-6	VI/160	1-6	Private
Musselshell	10N	31E	20	W½E½	160.00	Gently to mod. rolling grassland.	41	1-6	VI/160	1-3-6-9	Public
Meagher	11N	9E	20	S½SW¼;SE¼SE¼	120.00	Mod. to strongly rolling grassland & conifer.	10	1-3-4-6	VI/49;VII/71	1-3-4-6	Public
Meagher	11N	9E	21	SW¼SW¼	40.00	Mod. to steeply rolling grassland & conifer.	2	1-3-4-6	VI/9;VII/31	1-3-4-6	Public
Meagher	11N	9E	29	E½;NE¼NW¼;NE¼SW¼	400.00	Mod. to steeply rolling grassland & conifer.	36	1-3-4-6	VI/139;VII/261	1-3-4-6	Public
Meagher	11N	9E	30	N½NE¼	80.00	Strongly rolling grassland and conifer.	10	1-4-6	VII/80	1-3-4-6	Public
Meagher	11N	9E	30	E½SE¼	80.00	Mod.to strongly rolling grassland and conifer.	7	1-4-6	VI/32;VII/48	1-3-4-6-7	Public
Meagher	11N	9E	31	Lot 2;SE¼NW¼	80.68	Nearly level to mod. rolling wet meadow & sagebrush.	23	1-4	VI/9;VII/72	1-4	Private
Meagher	11N	9E	31	NE¼SE¼	40.00	Mod. rolling sagebrush and conifer.	8	1-4-6	VI/34;VII/6	1-4-6	Private
Meagher	11N	9E	33	NW¼NE¼;NE¼NW¼	80.00	Steeply rolling conifer.	0	4-6-7	VIII/80	4-6-7	Public
Meagher	11N	9E	33	E½SE¼	80.00	Very steeply rolling conifer.	0	3-4-9	VIII/80	3-4-6-7-9	Public
Wheatland	11N	14E	22	N½NW¼;SW¼NW¼;NW¼SW¼	160.00	Rough, wooded,mountainous	44	1-4-6	VII/160	1-4-6-7	Private
Wheatland	11N	14E	22	NW¼SE¼	40.00	Rough, wooded, mountainous	11	1-4-6	VII/40	1-4-6-7	Private
Judith Basin	11N	15E	9	NE¼SW¼	40.00	Mod. rolling grassland.	7	1-4-6	VII/40	1-4-6	Private
Fergus	11N	17E	13	SW¼NE¼	40.00	Rough and mountainous	10	1-6-7	VII/40	1-6-7	Public
Fergus	11N	18E	18	NE¼NW¼	40.00	Mod. sloping woodland	2	1-6-7	VIII/40	1-6-7	N. For. w/d Public
Fergus	11N	18E	18	Lot 3	34.90	Mod. sloping woodland	2	1-6-7	VIII/35	1-6-7	~~Public~~ SOLD

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County	Twp	Range	Sec	Subdivision	Acres	General Land Character	AUMs	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
Golden Valley	11N	19E	35	E½E½	160.00	Gently rolling conifer	16	1-4-6	VII/160	1-4-6	Private
Musselshell	11N	23E	23	NW¼NW¼	40.00	Strongly rolling grassland	11	1-6	VII/40	1-6	Private
Musselshell	11N	24E	30	SE¼NE¼	40.00	Gently to strongly rolling grassland.	10	1-6	VI/11;VII/29	1-6	Private
Musselshell	11N	26E	24	SW¼NW¼	40.00	Gently rolling sage.	11	1-6	VI/40	1-6	Private
Musselshell	11N	26E	26	SE¼	160.00	Gently rolling sage.	35	1-6	VI/160	1-6	Public
Musselshell	11N	27E	18	NE¼NE¼	40.00	Gently to mod. rolling grassland.	10	1-6	VI/40	1-5-6	Public
Musselshell	11N	28E	22	N½N½	160.00	Strong sloping and hilly grassland.	35	1-6	VI/160	1-6	Private
Musselshell	11N	28E	30	Lots 1-3;E½NW¼;NE¼	338.59	Gently to mod. rolling sage	63	1-6	VI/332;VIII/7	1-6	Private
Musselshell	11N	29E	12	W½	320.00	Gently to mod. rolling grassland.	71	1-6	VI/320	1-6-9	Public
Musselshell	11N	29E	12	Lot 4	51.63	Gently to mod. rolling grassland.	12	1-6	VI/52	1-6	Private
Musselshell	11N	29E	20	SW¼NE¼	40.00	Strong sloping and hilly grassland.	9	1-6	VI/40	1-6	Private
Musselshell	11N	29E	20	NE¼SW¼	40.00	Strong sloping and hilly grassland.	8	1-6	VI/40	1-6	Private
Musselshell	11N	29E	22	S½S½	160.00	Gently to mod.rolling sage.	37	1-6	VI/160	1-6	Private
Musselshell	11N	29E	32	Lot 4;NW¼SW¼;W½NW¼	158.90	Strong sloping and hilly grassland.	45	1-6	VI/159	1-6	Private
Musselshell	11N	30E	2	Lots 1-2;S½NE¼;SE¼	324.09	Gently to mod. rolling greasewood.	72	1-4-6	VI/324	1-3-4-6	Public
Musselshell	11N	30E	10	All	640.00	Strong sloping & hilly greasewood.	142	1-4-5-6-9	VI/640	1-4-5-6-9	Public
Musselshell	11N	30E	34	All	640.00	Gently to mod. rolling grass (sage).	152	1-6	VI/640	1-6	Private
Musselshell	11N	31E	6	Lot 7	47.08	Strong sloping and hilly sage.	9	1-6	VI/47	1-6	Private
Musselshell	11N	31E	8	W½NW¼;NE¼NW¼;NW¼NE¼	160.00	Gently to mod. rolling sage.	32	1-6	VI/160	1-6	Private
Musselshell	11N	31E	30	SE¼NW¼	40.00	Gently to mod.rolling sage.	8	1-6	VI/40	1-6	Private
Musselshell	11N	34E	34	W½NW¼	80.00	Gently undulating sage - greasewood.	12	1-6	VII/80	1-6	Private
Judith Basin	12N	12E	1	Lot 1	58.79	Gently to strongly rolling grassland and conifer.	12	1-4	VI/28;VII/31	1-4	Private
Judith Basin	12N	12E	1	Lot 4	58.95	Mod. rolling grassland	16	1-4	VI/59	1-4	Private
Judith Basin	12N	12E	1	E½SW¼	80.00	Gently to strongly rolling grassland and conifer.	18	1-4	VI/45;VII/35	1-4	Private
Judith Basin	12N	12E	15	Lots 3,4,5	120.65	Mod. to strongly rolling grassland.	48	1-4	VII/121	1-4	Public
Judith Basin	12N	12E	17	E½NE¼;SW¼NE¼;S½NW¼;NW¼SW¼ SE¼	400.00	Mod. to very steeply rolling grassland and waste.	129	1-4-6	VI/210;VIII/190	1-4-6	Public
Judith Basin	12N	12E	18	SW¼NE¼;Lots 3,4	118.62	Mod.to very steeply rolling grassland and waste.	34	1-4	VI/116;VIII/3	1-4	Public

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County	Twp	Range	Sec	Subdivision	Acres	General Land Character	AUMs	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
Judith Basin	12N	13E	3	SW¼NW¼	40.00	Gently to mod. rolling grassland.	12	1-4	VI/40	1-4	Private
Judith Basin	12N	13E	3	NW¼SE¼	40.00	Gently to mod. rolling grassland.	12	1-4	VI/40	1-4	Private
Judith Basin	12N	13E	6	Lot 5	24.91	Gently to strongly rolling grassland.	6	1-4	VI/17;VII/8	1-4	Private
Judith Basin	12N	13E	17	SW¼SE¼	40.00	Gently to steeply rolling grassland & browse-shrub.	9	1-4	VI/31;VII/9	1-4	Private
Judith Basin	12N	13E	25	NW¼SW¼	40.00	Mod. to steeply rolling grassland and waste.	10	1-4-6	VI/29;VIII/11	1-4-6	Public
Judith Basin	12N	13E	26	Lots 1-8;SW¼NE¼	356.17	Mod. to steeply rolling grassland and waste	72	1-4-6	VI/147;VIII/209	1-4-6	Public
Judith Basin	12N	13E	27	Lots 1,5-8	199.96	Mod. to steeply rolling grassland and waste.	26	1-4-6	VI/4;VIII/196	1-4-6	Public
Judith Basin	12N	13E	28	Lots 5-8	159.25	Steeply rolling waste(wildlife)	21	1-4-6	VIII/159	1-4-6	Public
Judith Basin	12N	13E	29	Lots 2-8	270.46	Steeply rolling waste(wildlife)	35	1-4-6	VIII/270	1-4-6	Public
Judith Basin	12N	13E	30	Lots 3-10	264.42	Steeply rolling waste(wildlife)	34	1-4-6	VIII/264	1-4-6	Public
Fergus	12N	17E	18	W½NE¼;SE¼NW¼;SE¼	280.00	Rough and mountainous	28	4-6	VIII/280	4-6	Public
Fergus	12N	17E	19	E½	320.00	Rough and mountainous	38	4-6	VIII/320	4-6	Public
Fergus	12N	17E	30	N½NE¼;SE¼NE¼	120.00	Rough and mountainous	14	4-6	VIII/120	4-6	Public
Fergus	12N	17E	30	Lots 1,2	96.03	Mod. to strongly rolling	24	1-4-6	VII/38;VIII/58	1-4-6	Public
Fergus	12N	17E	32	SW¼NE¼	40.00	Rough wooded rangeland.	7	1-4-6	VII/40	1-4-6-7	Public
Fergus	12N	20E	4	SW¼SE¼	40.00	Gently to mod. rolling	3	1	VI/15;VII/25	1-3-7	Public
Fergus	12N	20E	7	Lots 3,4;E½SW¼	148.82	Rough and mountainous	2	6	VII/149	3-6-7	Public
Fergus	12N	20E	8	NE¼NE¼	40.00	Mod. rolling rangeland	5	1	VI/28;VII/12	1-3-7	Public
Fergus	12N	20E	9	N½N½;SE¼NE¼;E½SE¼	280.00	Mod. rolling rangeland	12	1	VI/40;VII/240	1-3-7	Public
Fergus	12N	20E	10	SW¼	160.00	Gently rolling rangeland.	7	1	VII/160	1-3-7	Public
Fergus	12N	20E	14	S½S½	160.00	Strongly rolling rangeland.	7	1-4	VII/160	4-6-7	Public
Fergus	12N	20E	15	N½NW¼	80.00	Mod. rolling rangeland	12	1	VI/50;VII/30	1-3-7	Public
Fergus	12N	20E	17	NW¼SE¼;S½SW¼	120.00	Gently to strongly rolling	21	1	VII/120	3-9	Public
Fergus	12N	20E	20	W½W½ NE¼NW¼;NW¼NE¼	240.00	Gently to strongly rolling	33	1	VII/240	3-9	Public
Fergus	12N	20E	20	NE¼SE¼	40.00	Strongly rolling grassland	7	1	VII/40	3-9	Public
Fergus	12N	20E	22	NW¼	160.00	Strongly to steeply rolling	47	1-4	VII/160	1-4	Private
Fergus	12N	20E	23	N½;NE¼SE¼;E½SW¼	440.00	Rough and mountainous	39	1-4	VI/82;VII/358	4-6-7	Public
Fergus	12N	20E	26	N½NW¼	80.00	Mod. to strongly rolling	12	1-4	VI/36;VII/44	4-6-7	Public

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County	Twp	Range	Sec	Subdivision	Acres	General Land Character	AUMs	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
Fergus	12N	20E	28	N½NW¼;SW¼NW¼	120.00	Rough and mountainous	14	1-7	VII/120	3-7	Public
Fergus	12N	20E	28	SW¼SW¼	40.00	Mod. sloping rangeland.	4	3-4-6	VIII/40	3-4-6-7	Public
Fergus	12N	21E	1	S½NW¼;NW¼SE¼;Lot 6	161.99	Gently rolling rangeland.	7	1-7	VII/162	6-7	Public
Fergus	12N	21E	8	SE¼NW¼;NE¼SW¼	80.00	Rough and mountainous	3	1-7	VII/80	6-7	Private
Fergus	12N	21E	9	SE¼NE¼	40.00	Rough and mountainous	2	1-7	VII/40	6-7	Private
Fergus	12N	21E	9	NE¼SW¼;NW¼SE¼;S½SE¼	160.00	Rough and mountainous	7	1-7	VII/160	6-7	Private
Fergus	12N	21E	12	W½NE¼;SW¼NW¼	120.00	Rough and mountainous	10	1-7	VII/120	6-7	Public
Fergus	12N	22E	6	NW¼SE¼	40.00	Gently rolling woodland.	2	1-7	VII/40	1-6-7	Private
Fergus	12N	22E	7	Lot 5;NE¼NW¼	83.36	Gently rolling woodland.	8	1-7	VII/83	1-6-7	Private
Fergus	12N	22E	8	SE¼NE¼;S½	360.00	Rough and mountainous.	23	1	VII/360	1-7	Public
Fergus	12N	22E	12	SW¼SE¼	40.00	Mod. rolling.	10	1	VII/40	1	~~Private~~ SOLD
Fergus	12N	22E	17	N½;N½SW¼;NW¼SE¼	440.00	Rough and mountainous	32	1	VII/440	1-7	Public
Fergus	12N	22E	18	N½NE¼	80.00	Rough and mountainous	3	1	VII/80	1-7	Public
Fergus	12N	22E	19	Lots 7,8	87.03	Rough and mountainous	4	1-7	VII/87	1-6-7	Private
Fergus	12N	22E	20	N½SW¼	80.00	Mod.to steep sloping.	9	1-7	VII/80	1-7	Private
Fergus	12N	22E	20	E½SE¼	80.00	Strong sloping.	18	1-7	VII/80	1-7	Private
Fergus	12N	22E	28	W½SE¼;E½SW¼;NW¼SW¼	200.00	Rough and mountainous.	25	1-7	VII/200	1-7	Private
Fergus	12N	22E	29	E½NE¼	80.00	Strong sloping woodland.	16	1-7	VII/80	1-7	Private
Fergus	12N	22E	30	S½SE¼	80.00	Strongly rolling rangeland.	14	1-7	VII/80	1-7	Private
Fergus	12N	22E	31	NE¼NE¼	40.00	Strongly rolling rangeland.	11	1-7	VII/40	1-7	Private
Fergus	12N	22E	33	SW¼NE¼	40.00	Mod. to strong sloping.	5	1	VII/40	1-7	Private
Fergus	12N	22E	34	SW¼NW¼	40.00	Rough and mountainous	2	1	VII/40	1-7	Private
Fergus	12N	22E	35	S½NW¼;NW¼NW¼	120.00	Strong sloping conifer	10	1	VII/120	1-7	Private
Fergus	12N	23E	1	SW¼NW¼	40.00	Gentle sloping grassland.	11	1	VII/40	1	~~Private~~ SOLD
Fergus	12N	23E	3	Lot 1;S½NE¼;SE¼NW¼	160.72	Mod. to strong sloping conifer and grassland.	28	1-6	VI/68;VII/93	1-4-6	Public
Fergus	12N	23E	7	Lot 4	39.45	Mod. sloping grassland.	11	1	VII/39	1	~~Private~~ SOLD
Fergus	12N	23E	14	NW¼	160.00	Mod. rolling grassland.	35	1	VI/160	1	Private
Fergus	12N	23E	15	NW¼NW¼	40.00	Mod. rolling grassland.	11	1	VII/40	1	~~Private~~ SOLD

Appendix A Continued

County	Twp	Range	Sec	Subdivision	Acres	General Land Character	AUMs	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
Fergus	12N	23E	17	SE¼NE¼;N½SE¼	120.00	Mod. rolling grassland.	36	1	VII/120	1	~~Private~~ SOLD
Fergus	12N	23E	28	SE¼NE¼	40.00	Mod. rolling grassland.	10	1	VII/40	1	Private
Fergus	12N	23E	34	NW¼SE¼	40.00	Strong sloping grassland.	7	1	VII/40	1	Private
Fergus	12N	24E	1	N½SE¼;SE¼NE¼	120.00	Gently to mod. rolling grassland and conifer.	22	1-6	VI/20;VII/100	1-6-7	Public
Fergus	12N	24E	1	SE¼SW¼	40.00	Mod. rolling sage-grass.	7	1	VII/40	1	Public
Fergus	12N	24E	4	SW¼SW¼	40.00	Strong sloping grassland.	10	1	VII/40	1	Private
Fergus	12N	24E	5	SE¼SE¼	40.00	Strong sloping grassland.	10	1	VII/40	1	Private
Fergus	12N	24E	6	Lot 6	35.76	Gently rolling grassland.	8	1	VII/36	1	~~Private~~ SOLD
Fergus	12N	24E	7	W½NE¼	80.00	Gently rolling grassland.	18	1	VII/80	1	~~Private~~ SOLD
Fergus	12N	24E	7	SE¼SW¼	40.00	Strong sloping conifer	8	1	VII/40	1	~~Private~~ SOLD
Fergus	12N	24E	8	SW¼SE¼	40.00	Mod. rolling grassland to strong sloping conifer.	6	1-6	VII/40	1-6	~~Private~~ SOLD
Fergus	12N	24E	9	S½SE¼;SE¼SW¼	120.00	Mod. rolling sage to very steep conifer.	24	1-6	VII/120	1-6	Private
Fergus	12N	24E	10	NW¼SE¼;SE¼SW¼	80.00	Gently to mod. rolling sage	14	1	VII/80	1	Public
Fergus	12N	24E	10	SE¼SE¼	40.00	Mod. rolling sage	7	1	VII/40	1	Public
Fergus	12N	24E	11	S½S½;SE¼NE¼	200.00	Mod. rolling sage	34	1	VII/200	1	Public
Fergus	12N	24E	12	NW¼;N½SW¼;SW¼SW¼	280.00	Mod. rolling sage	47	1	VII/280	1	Public
Fergus	12N	24E	13	SW¼SW¼	40.00	Nearly level grassland to mod. rolling shrub-browse.	8	1	VII/40	1-2	Private
Fergus	12N	24E	14	N½NW¼;NW¼NE¼	120.00	Mod. rolling sage.	20	1	VII/120	1	Public
Fergus	12N	24E	15	NE¼NE¼	40.00	Mod. rolling sage.	7	1	VII/40	1	Public
Fergus	12N	24E	18	Lot 1	34.82	Gently sloping grassland to very steep conifer.	5	1-6	VII/35	1-6	~~Private~~ SOLD
Petroleum	12N	27E	10	S½	320.00	Gently rolling grassland.	74	1-6	VI/320	1-6	Private
Petroleum	12N	27E	12	N½	320.00	Mod. rolling sagebrush and grassland.	74	1-6	VI/320	1-6	Public
Petroleum	12N	27E	14	SE¼	160.00	Mod. rolling sagebrush and grassland.	38	1-6	VI/160	1-6	Public
Petroleum	12N	29E	18	NE¼SE¼	40.00	Mod. rolling grassland	9	1-6	VI/40	1-6	Private
Petroleum	12N	29E	20	NW¼NW¼	40.00	Gently rolling grassland.	9	1-6	V/40	1-2-6	Private
Petroleum	12N	30E	6	Lots 8-15	283.52	Gently to strongly rolling sagebrush rangeland.	31	1-6	VII/284	1-6	Public
Petroleum	12N	30E	8	E½;E½W½	480.00	Mod. rolling sagebrush rangeland.	53	1-6	VII/480	1-6	Public
Petroleum	12N	30E	10	All	640.00	Strongly rolling sagebrush rangeland	75	1-6	VI/33;VII/607	1-6	Public

County	Twp	Range	Sec	Subdivision	Acres	General Land Character	AUMs	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
Petroleum	12N	30E	20	S½	320.00	Strongly rolling sagebrush rangeland.	35	1-6	VII/320	1-6	Private
Petroleum	12N	30E	28	SE¼SE¼	40.00	Gently rolling sagebrush rangeland.	4	1-6	VII/40	1-6	Private
Petroleum	12N	30E	34	S½	320.00	Mod. rolling sagebrush rangeland.	35	1-6	VI/320	1-6	Public
Petroleum	12N	31E	18	Lots 1-4;SE¼NW¼;E½SW¼	281.52	Gently to mod. rolling sagebrush rangeland	40	1-4-6	VI/135;VII/123; VIII/24	1-4-6	Public
Petroleum	12N	31E	20	NE¼SW¼	40.00	Nearly level to mod. sloping grassland and river bottom.	9	1-2-6	III/17;VI/23	1-2-3-6	Public
Petroleum	12N	31E	20	SW¼SW¼	40.00	Nearly level to mod. sloping grassland and river bottom.	10	1-6	III/4;VI/36	1-3-9	Public
Judith Basin	13N	11E	14	Lot 8	8.67	Mod. rolling grassland.	2	1-4	VII/9	1-4	Public
Judith Basin	13N	11E	22	Lots 5,15	25.44	Strongly rolling waste	6	1-4	VII/25	1-4	Public
Judith Basin	13N	11E	23	Lots 11,16,17 and 18	14.27	Mod. rolling grassland.	4	1-4	VII/14	1-4	Public
Judith Basin	13N	11E	24	Lots 8,9	.342	Mod. rolling grassland	0	1-4	VII/.342	1-4	Public
Judith Basin	13N	12E	4	SW¼NW¼	40.00	Strongly rolling grassland	10	1-4	VII/40	1-4	Private
Judith Basin	13N	12E	11	W½NW¼	80.00	Mod. to strongly rolling grassland and conifer	12	1-4	VII/80	1-4-6	Private
Judith Basin	13N	12E	15	N½NW¼	80.00	Mod. to strongly rolling grassland and conifer.	16	1-4-6	VII/80	1-4-6-7	Private
Judith Basin	13N	12E	19	Lots 1 and 2	79.84	Gently to strongly rolling grassland.	13	1-4	VII/80	1-4-8	Public
Judith Basin	13N	12E	25	SE¼SE¼	40.00	Mod. rolling grassland.	8	1-4	VII/40	1-4	Private
Judith Basin	13N	12E	31	NE¼SW¼	40.00	Mod. rolling grassland.	8	1-4	VII/40	1-4	Private
Judith Basin	13N	12E	32	SE¼NW¼	40.00	Mod. rolling grassland.	8	1-4	VII/40	1-4	Private
Judith Basin	13N	13E	8	E½NW¼	80.00	Mod. rolling grassland and conifer.	15	1-4-6	VII/80	1-4-6-7	Private
Judith Basin	13N	13E	17	W½NW¼	80.00	Mod. to strongly rolling grassland and conifer.	16	1-4-6	VI/37;VII/43	1-4-6-7	Private
Judith Basin	13N	13E	18	NW¼NE¼	40.00	Mod. to strongly rolling grassland.	12	1-4	VI/40	1-4	Private
Judith Basin	13N	13E	20	SW¼NW¼	40.00	Mod. to strongly rolling grassland.	7	1-4	VII/40	1-4	Private
Judith Basin	13N	13E	30	NE¼NW¼	40.00	Mod. rolling grassland.	8	1-4	VII/40	1-4	Private
Judith Basin	13N	13E	33	SW¼NE¼	40.00	Gently to mod. rolling grassland.	12	1-4	VI/40	1-4	Private
Fergus	13N	17E	10	NE¼SW¼	40.00	Mod. sloping conifer.	5	4-6	VIII/40	4-6	Private
Fergus	13N	17E	12	SW¼NW¼	40.00	Rough and mountainous	4	4-6	VIII/40	4-6	Private
Fergus	13N	17E	25	SE¼;S½SW¼	240.00	Rough and mountainous	23	4-6	VII/21;VIII/219	4-6-9	Public
Fergus	13N	17E	35	SE¼SE¼	40.00	Rough and mountainous	4	4-6	VIII/40	4-6-9	Public
Fergus	13N	18E	25	Lot 3	45.06	Rough and mountainous	5	1-6	VIII/45	4-6-9	Public

Appendix A Continued

County	Twp	Range	Sec	Subdivision	Acres	General Land Character	AUMs	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
Fergus	13N	18E	29	SW¼SW¼	40.00	Rough and mountainous	4	4-6	VIII/40	4-6-9	Public
Fergus	13N	18E	30	S½SE¼	80.00	Rough and mountainous	7	4-6	VIII/80	4-6-9	Public
Fergus	13N	19E	17	SE¼SE¼	40.00	Rough and mountainous	0	1-4-6-7	VII/40	1-4-6-7	Private
Fergus	13N	19E	24	SW¼SW¼	40.00	Rough and mountainous	13	1-4-6	VII/40	1-4-6-7	Private
Fergus	13N	20E	2	Lot 2	39.39	Steep sloping grassland.	18	1	VII/39	1-5	Public
Fergus	13N	20E	5	SW¼SE¼	40.00	Rough and mountainous	12	1-4-6	VII/40	1-4-6-7	Private
Fergus	13N	20E	9	NE¼SW¼	40.00	Rough and mountainous	3	1-4-6	VII/40	1-4-6-7	Private
Fergus	13N	20E	15	NW¼NW¼	40.00	Strongly sloping conifer	6	1-6	VII/40	1-6-7	Private
Fergus	13N	20E	15	SE¼SE¼	40.00	Gentle to strong sloping grassland	10	1-9	VII/40	1-9	Private
Fergus	13N	20E	22	E½NW¼	80.00	Gently rolling grassland to mod.sloping conifer.	19	1-3-6-9	VII/80	1-3-6-9	Public
Fergus	13N	21E	15	NW¼SW¼	40.00	Rough and mountainous	2	1-4-6-7	VII/40	1-3-4-6-7	Public
Fergus	13N	21E	18	SW¼SE¼	40.00	Rough and mountainous	2	1-4-6-7	VII/40	1-3-4-6-7	Public
Fergus	13N	21E	20	SE¼NE¼;SE¼	200.00	Rough and mountainous	17	1-4-6-7	VII/200	1-3-4-6-7	Public
Fergus	13N	21E	21	SW¼NE¼;NE¼NW¼;S½NW¼	160.00	Rough and mountainous	13	1-4-6-7	VII/160	1-3-4-6-7	Public
Fergus	13N	21E	21	SE¼SE¼	40.00	Rough and mountainous	3	1-4-6-7	VII/40	1-3-4-6-7	Public
Fergus	13N	21E	22	W½SW¼	80.00	Mod. sloping grassland to rough and mountainous.	7	1-4-6-7	VII/80	1-3-4-6-7	Public
Fergus	13N	21E	28	NW¼NE¼	40.00	Rough and mountainous	3	1-6-7	VII/40	1-3-4-6-7	Public
Fergus	13N	21E	28	NW¼NW¼	40.00	Rough and mountainous	3	1-4-6-7	VII/40	1-3-4-6-7	Public
Fergus	13N	21E	28	SW¼SE¼	40.00	Rough and mountainous	2	1-4-6	VII/40	1-3-4-6-7	Public
Fergus	13N	21E	29	N½NE¼	80.00	Rough and mountainous	6	1-4-6-7	VII/80	1-3-4-6-7	Public
Fergus	13N	21E	33	NW¼NE¼	40.00	Rough and mountainous	1	1-4-6	VII/40	1-3-4-6-7	Public
Fergus	13N	21E	34	SW¼NW¼;N½SW¼	120.00	Rough and mountainous	7	1-4-6	VII/120	1-3-4-6-7	Public
Fergus	13N	21E	35	W½NW¼	80.00	Rough and mountainous	3	1-4-6-7	VII/80	3-4-6-7	Public
Fergus	13N	22E	2	Lot 4	39.52	Rough and mountainous	3	1-6-7	VII/40	1-6-7	~~Private~~ SOLD
Fergus	13N	22E	6	W½SE¼	80.00	Gently rolling grassland to rough and mountainous.	13	1-4-6-7	VII/80	1-4-6-7	Private
Fergus	13N	22E	8	SW¼NW¼	40.00	Gently sloping to rough & mountainous	13	1-4-6-7	VII/40	1-4-6-7	Private
Fergus	13N	23E	1	Lot 4	40.75	Strongly rolling grassland.	10	1	VII/41	1	Private
Fergus	13N	23E	15	SW¼NE¼	40.00	Nearly level grassland.	11	1-4	VII/40	1-4	Private

Appendix A Continued

County	Twp	Range	Sec	Subdivision	Acres	General Land Character	AUMs	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
Fergus	13N	23E	33	SE¼SE¼	40.00	Strong sloping conifer.	2	1-6	VII/40	1-4-6	Public
Fergus	13N	24E	1	SW¼NE¼;W½SE¼;SW¼NW¼;SW¼	320.00	Gently to steep sloping grassland.	67	1	VII/320	1	Public
Fergus	13N	24E	2	NW¼SE¼	40.00	Steeply rolling grassland.	10	1	VII/40	1-5	Private
Fergus	13N	24E	12	W½NE¼;E½NW¼;NW¼NW¼	200.00	Gentle to steep sloping grassland.	43	1	V/9;VII/191	1	Public
Fergus	13N	24E	12	Lot 3	44.77	Nearly level to mod. rolling grassland.	11	1	VII/45	1	Public
Fergus	13N	24E	29	NW¼NE¼	40.00	Mod. rolling grassland.	9	1	VII/40	1	Private
Petroleum	13N	25E	4	Lots 1,2	82.21	Mod.rolling grass and sagebrush rangeland.	14	1-2-9	IV/10;VII/72	1-2-9	Public
Petroleum	13N	26E	6	Lot 7;NW¼SE¼	76.53	Gently rolling grass and sagebrush rangeland.	19	1-6	VI/76	1-4-6	Public
Petroleum	13N	27E	24	NW¼;W½SW¼;SE¼SW¼	280.00	Gently rolling to strong sloping rangeland.	39	1-6	VI/280	1-6	Public
Petroleum	13N	27E	26	N½NW¼	80.00	Gently rolling to strong sloping rangeland.	11	1-6	VI/80	1-6	Public
Petroleum	13N	29E	2	Lots 1-4;S½N½	346.52	Strongly rolling sage and grassland rangeland.	77	1-6	VI/347	1-6	Public
Petroleum	13N	29E	4	Lots 1-4;S½N½	344.44	Gently rolling to level rangeland.	67	1-6	VI/344	1-6	Public
Petroleum	13N	29E	6	All	664.28	Gently to mod. rolling grassland.	107	1-6	VI/664	1-6	Private
Judith Basin	14N	11E	3	SE¼SW¼;SW¼SE¼	80.00	Steeply rolling conifer	0	1-4-6	VII/80	1-4-6-7	Public
Judith Basin	14N	11E	27	Lot 1	39.88	Strongly to steeply rolling conifer.	0	1-4-6	VII/40	1-4-6-7	Public
Judith Basin	14N	11E	27	Lot 3;NE¼SW¼	79.62	Strongly to steeply rolling grassland and conifer.	19	1-4-6	VII/80	1-4-6-7	Public
Judith Basin	14N	12E	7	N½NE¼	80.00	Gently to strongly rolling grassland.	8	1-4	VII/80	1-4	Private
Judith Basin	14N	12E	13	SW¼SW¼	40.00	Gently rolling grassland.	6	1-4	VII/40	1-4	Private
Judith Basin	14N	12E	31	NE¼NE¼	40.00	Mod. to steeply rolling grassland.	7	1-4-6	VII/40	1-4-6-7	Private
Judith Basin	14N	13E	31	SW¼SE¼	40.00	Strongly rolling grassland	13	1-4	VI/40	1-4	Private
Fergus	14N	21E	4	NW¼SE¼	40.00	Nearly level hayland to steep sloping conifer.	14	1-2-9	V/4;VII/36	1-2-9	Private
Fergus	14N	22E	13	SW¼NE¼	40.00	Mod. sloping conifer	9	1-6-7	VII/40	1-6-7	Public
Fergus	14N	22E	33	N½SE¼	80.00	Rough and mountainous	8	1-4-6-7	VII/80	1-4-6-7	Private
Fergus	14N	22E	34	N½SW¼	80.00	Rough and mountainous	6	1-4-6-7	VII/80	1-4-6-7	Private
Fergus	14N	22E	34	SE¼NE¼	40.00	Rough and mountainous	3	1-4-6-7	VII/40	1-4-6-7	Private
Fergus	14N	23E	3	SW¼NW¼	40.00	Mod. rolling grassland.	11	1	VII/40	1-3-8-9	Public
Fergus	14N	24E	23	NE¼NW¼	40.00	Gently rolling grassland.	11	1	VI/40	1	Public
Fergus	14N	24E	30	SE¼SE¼	40.00	Gently rolling conifer.	6	1-4-7	VII/40	1-4-7	Private

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County	Twp	Range	Sec	Subdivision	Acres	General Land Character	AUMs	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
Fergus	14N	24E	33	NE¼SW¼	40.00	Gently rolling conifer	4	1-4-7	VII/40	1-4-7	Private
Fergus	14N	24E	35	NW¼NW¼	40.00	Gentle to strong sloping grassland.	8	1	VII/40	1	Private
Fergus	14N	24E	35	NE¼SW¼	40.00	Gentle to strong sloping grassland.	7	1	VII/40	1	Private
Petroleum	14N	27E	33	NE¼NE¼	40.00	Gently to strongly rolling grassland range.	12	1-6	VI/40	1-4-6	Public
Petroleum	14N	27E	34	SW¼NW¼	40.00	Gently to strongly rolling grassland range.	12	1-6	VI/40	1-4-6	Public
Petroleum	14N	28E	15	SW¼NW¼;NW¼SW¼	80.00	Mod. rolling to steep grassland range.	20	1-6	VI/80	1-6	Public
Judith Basin	15N	10E	3	SW¼SE¼	40.00	Very strongly rolling grassland.	11	1-4	VII/40	1-4	Private
Judith Basin	15N	10E	4	SE¼NE¼	40.00	Strongly rolling grassland.	14	1-4-6	VII/40	1-3-4-6	Public
Judith Basin	15N	10E	4	W½SE¼	80.00	Strongly to steeply rolling grassland and conifer.	27	1-4-6	VII/80	1-3-4-6-7	Public
Judith Basin	15N	10E	9	W½NE¼	80.00	Strongly to steeply rolling grassland and conifer.	20	1-4-6	VII/80	1-3-4-6-7	Public
Judith Basin	15N	10E	14	NE¼NW¼	40.00	Steeply rolling conifer.	3	1-4-6	VIII/40	1-3-4-6	Public
Judith Basin	15N	10E	15	NW¼NW¼	40.00	Steeply rolling conifer.	3	1-4-6	VIII/40	1-4-6	Public
Judith Basin	15N	10E	21	NW¼SW¼	40.00	Very steeply rolling grassland and conifer.	8	1-4-6	VII/15;VIII/25	1-3-4-6	Public
Judith Basin	15N	10E	28	W½NW¼:SE¼NW¼:SW¼NE¼	160.00	Strongly to very steeply rolling grassland & conifer	29	1-4-6	VII/40;VIII/120	1-3-4-6	Public
Judith Basin	15N	11E	5	Lot 4	40.82	Strongly rolling grassland.	8	1-4	VII/41	1-4	Private
Judith Basin	15N	11E	6	SW¼NE¼	40.00	Strongly rolling grassland.	8	1-4	VII/40	1-4	Private
Judith Basin	15N	11E	6	SE¼SE¼	40.00	Strongly rolling grassland.	8	1-4	VII/40	1-4	Private
Judith Basin	15N	11E	11	SE¼SE¼	40.00	Gently to strongly rolling grassland.	9	1-4	VII/40	1-4	Private
Judith Basin	15N	11E	31	Lots 2-4;SE¼NW¼;E½SW¼;NW¼SE¼	262.76	Strongly to steeply rolling grassland and conifer.	66	1-4-6	VII/263	1-4-6	Private
Judith Basin	15N	11E	34	NE¼NW¼	40.00	Steeply rolling grassland.	7	1-4-6	VII/40	1-4-6	Private
Fergus	15N	19E	2	SE¼SE¼	40.00	Rough and mountainous	6	1	VIII/40	3-4-6	Private
Fergus	15N	19E	25	NW¼SW¼	40.00	Mod. rolling grassland and conifer.	18	1	VI/8;VII/32	1-6	Private
Fergus	15N	20E	7	E½NE¼NE¼;N½SE¼NE¼	40.00	Rough and mountainous	10	1	VII/40	1-3	Public
Fergus	15N	22E	4	NW¼SE¼	40.00	Mod. rolling grassland.	7	1-9	VII/40	1-9	Private
Fergus	15N	22E	8	NW¼SW¼	40.00	Strongly rolling grassland.	12	1	VII/40	1	Public
Fergus	15N	23E	17	S½SE¼;SE¼SW¼	120.00	Rough and mountainous	19	1-6-7	VII/120	1-6-7	Private
Fergus	15N	23E	17	SW¼NW¼	40.00	Rough and mountainous	7	1-6-7	VII/40	1-6-7	Private
Fergus	15N	23E	18	SE¼NE¼	40.00	Rough and mountainous	6	1-6-7	VII/40	1-6-7	Private

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County	Twp	Range	Sec	Subdivision	Acres	General Land Character	AUMs	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
Petroleum	15N	27E	21	SW¼SW¼	40.00	Gently to steeply rolling grassland.	7	1-6-9	VI/40	1-6-9	Public
Petroleum	15N	27E	24	NE¼NE¼	40.00	Gently rolling grassland.	13	1-6	VI/40	1-6	Public
Petroleum	15N	27E	25	SW¼NW¼	40.00	Gently to steeply rolling grassland.	10	1-6	VI/40	1-6	Private
Petroleum	15N	27E	28	NE¼SE¼	40.00	Steeply rolling grassland.	13	1-6	VI/40	1-6	Public
Petroleum	15N	28E	19	Lot 1	48.70	Gently to steeply rolling grassland.	16	1-6	VI/49	1-6	Public
Petroleum	15N	28E	22	S½NW¼	80.00	Mod. rolling grassland.	24	1-6	VI/80	1-6	Public
Petroleum	15N	28E	26	SE¼SW¼	40.00	Gently rolling grassland.	11	1-6	VI/40	1-6	Public
Petroleum	15N	28E	34	S½NE¼;NW¼NE¼	120.00	Gently rolling to steep sloping rangeland.	27	1-6	VI/120	1-6	Public
Petroleum	15N	28E	35	SW¼NE¼	40.00	Gently to steeply rolling rangeland.	8	1-6	VI/40	1-6	Public
Judith Basin	16N	9E	13	NW¼SW¼	40.00	Strongly rolling grassland.	8	1-4-6-7	VII/40	1-3-4-6-7	Public
Judith Basin	16N	9E	14	Lots 5-12	334.20	Strong to very steeply rolling grassland and conifer.	14	1-4-6-7	VII/63;VIII/271	1-3-4-6-7	Public
Judith Basin	16N	9E	15	Lots 3-12;S½NW¼	489.25	Very steeply rolling conifer	0	1-4-6-7	VIII/489	1-3-4-6-7	Public
Judith Basin	16N	10E	7	SE¼SW¼	40.00	Mod. rolling grassland.	11	1-4	VII/40	1-4	Public
Judith Basin	16N	10E	12	N½NE¼	80.00	Mod. to very steep rolling grassland.	13	1-4	VII/80	1-4	Private
Judith Basin	16N	10E	12	NE¼SE¼	40.00	Mod. to very steep rolling grassland.	6	1-4	VII/40	1-4	Private
Judith Basin	16N	10E	27	SE¼SW¼	40.00	Mod. rolling grassland	11	1-4	VII/40	1-4	Private
Judith Basin	16N	10E	28	Lots 6 and 10	80.79	Strong rolling grassland.	26	1-4-6	VII/81	1-3-4-6	Public
Judith Basin	16N	10E	33	Lots 2 and 6	79.66	Strongly rolling grassland.	26	1-4-6	VII/80	1-3-4-6	Public
Judith Basin	16N	10E	33	NE¼SE¼	40.00	Strongly rolling grassland.	13	1-4-6	VII/40	1-3-4-6	Public
Judith Basin	16N	11E	4	SE¼SE¼	40.00	Mod. rolling grassland	11	1-4	VI/40	1-4-8	Public
Judith Basin	16N	11E	7	Lot 4;SE¼SW¼	70.96	Mod. to very steeply rolling grassland.	12	1-4-6	VII/71	1-4-6	Private
Judith Basin	16N	11E	9	NE¼NE¼	40.00	Mod. rolling grassland.	11	1-4	VI/40	1-4-8	Public
Judith Basin	16N	11E	15	NE¼SE¼	40.00	Strongly rolling grassland.	7	1-4	VII/40	1-4	Private
Judith Basin	16N	11E	19	SW¼NE¼;NW¼SE¼	80.00	Mod. rolling grassland.	17	1-4	VII/80	1-4	Private
Judith Basin	16N	11E	32	NE¼SW¼	40.00	Strongly rolling grassland.	8	1-4	VII/40	1-4	Private
Judith Basin	16N	14E	5	Lots 2-4	114.13	Mod. to steeply rolling grassland.	23	1-4	VI/66;VII/48	1-4	Private
Judith Basin	16N	14E	14	NE¼SE¼	40.00	Mod. rolling grassland.	11	1-4	VI/40	1-4	Public
Fergus	16N	17E	2	Lots 5-7;SE¼NW¼;E½SW¼	229.44	Rough and mountainous	41	1-6-7	VII/13;VIII/216	3-6-7	Public

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County	Twp	Range	Sec	Subdivision	Acres	General Land Character	AUMs	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
Fergus	16N	17E	3	Lots 5-10;S½NW¼	300.70	Rough and mountainous	67	1-6-7	VII/102;VIII/199	3-6-7	Public
Fergus	16N	17E	6	Lot 1	39.73	Strongly rolling grassland.	8	1	VII/40	1	Private
Fergus	16N	17E	6	Lots 3,4	79.38	Strongly rolling grassland.	19	1	VI/53;VII/26	1	Private
Fergus	16N	17E	8	NE¼NE¼	40.00	Mod. rolling grassland.	10	1	VII/40	1	Private
Fergus	16N	17E	10	Lots 1,2	81.18	Rough and mountainous	18	1-6-7	VII/23;VIII/58	3-6-7	Public
Fergus	16N	17E	12	E½NE¼;SW¼NE¼	120.00	Rough and mountainous	20	1-6	VII/120	1-6-7	Public
Fergus	16N	18E	4	Lot 1	33.16	Gently sloping grassland.	4	1	VII/33	1	Private
Fergus	16N	20E	35	NE¼SE¼	40.00	Steeply sloping grassland and conifer.	6	1	VII/40	1	Private
Fergus	16N	21E	3	NW¼SW¼	40.00	Gently rolling grassland.	7	1-4	VI/40	1-4	Public
Fergus	16N	21E	11	NW¼NW¼	40.00	Very steep sloping rangeland	8	1	VII/40	1	Private
Fergus	16N	21E	25	SW¼SE¼	40.00	Mod. rolling conifer.	2	1-6	VII/40	1-6-7	Public
Fergus	16N	22E	1	NW¼SW¼	40.00	Mod. rolling grassland	7	1	VII/40	1	Private
Fergus	16N	22E	3	Lots 3,4;SE¼NW¼	75.83	Gently rolling grassland.	7	1	VII/76	1	Private
Fergus	16N	22E	4	Lots 1-3;SW¼NE¼	98.78	Gently rolling grassland.	7	1	VII/99	1	Private
Fergus	16N	23E	2	Lot 4	16.06	Mod. rolling sagebrush	2	1	VII/16	1	Public
Fergus	16N	23E	3	Lots 1-3;S½NE¼;SE¼NW¼	165.98	Mod. rolling sagebrush	17	1	VII/144;VIII/22	1	Public
Fergus	16N	23E	10	SW¼NW¼	40.00	Mod. rolling grassland.	5	1-8-9	VII/40	1-8-9	Public
Fergus	16N	23E	10	NE¼SW¼	40.00	Mod. rolling grassland.	5	1-8	VII/40	1-8	Public
Fergus	16N	23E	21	NW¼NE¼	40.00	Gently rolling grassland	7	1	VI/40	1	Public
Fergus	16N	23E	31	SE¼SE¼	40.00	Mod.rolling sagebrush & conifer	6	1	VII/40	1	Public
Judith Basin	17N	11E	1	Lot 1	39.91	Nearly level to steeply rolling grassland.	11	1-4	VII/40	1-4	Private
Judith Basin	17N	11E	1	Lot 4	39.56	Gently to strongly rolling grassland.	13	1-4	VII/40	1-4	Private
Judith Basin	17N	11E	11	SE¼NE¼	40.00	Nearly level to strong rolling grassland.	9	1-4	VII/40	1-4	Private
Judith Basin	17N	11E	11	SE¼SW¼	40.00	Nearly level to strong rolling grassland.	9	1-4	VII/40	1-4	Private
Judith Basin	17N	11E	22	NW¼SW¼	40.00	Nearly level to strong rolling grassland.	11	1-4	VII/40	1-4	Private
Judith Basin	17N	14E	23	NW¼SW¼	40.00	Gently rolling grassland	7	1-4	VII/40	1-4	Private
Judith Basin	17N	14E	24	NE¼SW¼	40.00	Mod. to steeply rolling grassland.	9	1-4	VII/40	1-4	Private
Judith Basin	17N	14E	32	S½SW¼	80.00	Mod. to steeply rolling grassland.	14	1-4	VI/29;VII/51	1-4	Private

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County	Twp	Range	Sec	Subdivision	Acres	General Land Character	AUMs	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
Fergus	17N	14E	13	S½SE¼	80.00	Steeply rolling grassland.	18	1	VII/80	1	Private
Fergus	17N	15E	1	S½SE¼;SE¼SW¼	120.00	Strongly rolling grassland.	13	1-9	VII/120	1-9	Private
Fergus	17N	17E	12	NW¼NW¼	40.00	Mod. sloping conifer.	6	1-6	VI/40	6-7	Private
Fergus	17N	17E	32	NE¼NE¼	40.00	Strongly sloping grassland.	6	1	VII/40	1	Private
Fergus	17N	17E	34	E½;E½NW¼;NE¼SW¼	440.00	Rough and mountainous	56	4-6	VIII/440	4-6-7	Public
Fergus	17N	17E	35	SW¼NW¼;W½SW¼	120.00	Rough and mountainous	14	4-6	VIII/120	4-6-7	Public
Fergus	17N	21E	19	SE¼SW¼	40.00	Steep sloping conifer.	8	1-6	VII/40	1-6	Private
Fergus	17N	21E	26	SE¼NE¼;NE¼SE¼	80.00	Nearly flat grassland.	16	1	VI/80	1	Public
Fergus	17N	21E	34	SE¼NW¼	40.00	Mod. rolling browse-shrub	3	1	VII/40	1	Private
Fergus	17N	22E	2	NE¼SW¼;SW¼SW¼	80.00	Strong sloping grassland.	17	1	VII/80	1	Public
Fergus	17N	22E	3	Lots 3,4;SE¼NW¼;SW¼NE¼	160.60	Steep sloping grassland.	34	1	VII/161	1	Private
Fergus	17N	22E	7	SE¼SE¼	40.00	Mod. rolling grassland.	8	1	VII/40	1-4	Public
Fergus	17N	22E	17	SW¼SW¼	40.00	Steep sloping grassland.	7	1-4-6	VII/40	1-3-4-6	Public
Fergus	17N	22E	18	Lots 1-4;E½W½;SW¼NE¼;W½SE¼;		Mod. to very steep sloping					
				SE¼SE¼	477.52	grassland and conifer.	38	1-4-6	VII/167:VIII/310	1-3-4-6	Public
Fergus	17N	22E	27	SE¼NE¼	40.00	Gently rolling sagebrush	3	1	VII/28:VIII/12	1	Private
Fergus	17N	22E	32	SE¼SE¼	40.00	Mod.rolling sagebrush-grass	3	1	VII/40	1	Private
Fergus	17N	22E	33	SW¼SW¼	40.00	Mod.rolling sagebrush-grass	3	1	VII/40	1	Private
Fergus	17N	23E	9	SE¼NE¼	40.00	Gently rolling grassland.	9	1	VII/40	1	Private
Fergus	17N	23E	14	NE¼SE¼	40.00	Gently rolling grassland.	7	1	VII/40	1	Private
Fergus	17N	23E	14	SW¼SE¼	40.00	Gently rolling grassland.	8	1	VII/40	1	Private
Fergus	17N	23E	14	NW¼SW¼	40.00	Gently rolling grassland.	9	1	VII/40	1	Private
Fergus	17N	23E	15	NE¼NW¼	40.00	Mod. rolling grassland.	6	1	VII/40	1	Private
Fergus	17N	23E	15	SE¼SW¼	40.00	Gently rolling grassland.	9	1	VII/40	1	Private
Fergus	17N	23E	21	W½NW¼;NW¼SW¼	120.00	Mod.rolling grassland.	20	1	VII/120	1	Public
Fergus	17N	23E	22	NW¼SW¼	40.00	Mod.rolling grassland.	10	1	VI/40	1	Private
Fergus	17N	23E	23	NW¼NE¼	40.00	Gently rolling grassland.	9	1	VII/40	1	Private
Fergus	17N	23E	25	NE¼SE¼	40.00	Gently rolling grassland.	9	1	VII/40	1	Private

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County	Twp	Range	Sec	Subdivision	Acres	General Land Character	AUMs	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
Fergus	17N	23E	33	S½SE¼	80.00	Mod.rolling sagebrush	9	1	VII/80	1	Public
Petroleum	17N	25E	3	S½SW¼;NE¼SE¼	120.00	Strongly rolling grassland	22	1-6	VII/120	1-6	Private
Petroleum	17N	25E	4	E½SE¼	80.00	Strongly rolling grassland.	14	1-6	VII/80	1-6	Private
Petroleum	17N	25E	10	N½NW¼	80.00	Strongly rolling grassland.	14	1-6	VII/80	1-6	Private
Judith Basin	18N	10E	3	NE¼SE¼	40.00	Nearly level to strongly rolling grassland.	8	1-4	VII/40	1-4	Private
Fergus	18N	17E	20	SW¼SW¼	40.00	Mod.rolling grassland.	12	1	VI/40	1	Private
Fergus	18N	21E	34	SE¼NE¼;N½SE¼	120.00	Mod.rolling grassland.	24	1	VI/120	1	Private
Fergus	18N	22E	1	SE¼SW¼	40.00	Mod.rolling grassland.	8	1	VII/40	1-2	Public
Fergus	18N	22E	12	NE¼NW¼	40.00	Mod.rolling grassland.	8	1	VII/40	1-2	Public
Fergus	18N	22E	13	SW¼NE¼	40.00	Mod.rolling sagebrush.	5	1	VII/40	1	Public
Fergus	18N	22E	13	E½SE¼	80.00	Mod.rolling sagebrush.	9	1	VII/80	1	Public
Fergus	18N	24E	35	SW¼	160.00	Mod.rolling grassland and gently rolling greasewood.	43	1	VII/160	1-4	~~Private~~ SOLD
Fergus	18N	25E	17	NE¼SW¼	40.00	Mod.rolling sagebrush.	11	1	VII/40	1	Private
Petroleum	18N	25E	24	N½SW¼	80.00	Strongly rolling sagebrush and grassland.	21	1-6	VII/80	1-6	Public
Petroleum	18N	26E	19	E½SW¼;NW¼SE¼	120.00	Mod. to steeply rolling sagebrush -grassland	32	1-6	VII/120	1-6	Public
Judith Basin	19N	9E	23	Lots 5-7;N½SE¼;NE¼SW¼	241.01	Steeply to very steeply rolling waste.	0	1-3-4	VIII/241	1-3-4	Public
Judith Basin	19N	9E	25	N½;NE¼SE¼	360.00	Mod.to very steeply rolling grassland and waste.	26	1-3-4	VII/108;VIII/252	1-3-4	Public
Judith Basin	19N	9E	26	Lots 5-7, 10,12	251.37	Mod.to very steeply rolling grassland and waste.	2	1-3-4	VII/7;VIII/244	1-3-4	Public
Judith Basin	19N	10E	14	SW¼SW¼	40.00	Nearly level to mod.rolling grassland.	8	1-4	VII/40	1-4	Private
Judith Basin	19N	10E	15	S½NW¼;NW¼NW¼;SW¼;W½SE¼; SW¼NE¼	400.00	Strongly to very steeply rolling grassland & waste.	74	1-4	VII/400	1-4	Private
Judith Basin	19N	10E	21	NW¼SE¼	40.00	Nearly level to mod.rolling grassland.	8	1-4	VII/40	1-4	Private
Judith Basin	19N	10E	22	SW¼NE¼	40.00	Gently to strongly rolling grassland.	11	1-4	VII/40	1-4	Private
Judith Basin	19N	10E	23	SW¼NW¼	40.00	Gently to strongly rolling grassland.	10	1-4	VII/40	1-4	Private
Judith Basin	19N	10E	27	SW¼NW¼	40.00	Nearly level to mod.rolling grassland.	8	1-4	VII/40	1-4	Private
Chouteau	19N	10E	4	W½SE¼	80.00	Strongly to very steeply rolling waste.	0	4-6	VIII/80	4-6	Public
Fergus	19N	16E	5	Lot 4	36.49	Gentle to steep sloping grassland.	7	1	VI/10;VII/26	1-4	Private
Fergus	19N	16E	11	S½SW¼	80.00	Nearly level grassland and cropland to very steep conifer	8	1-2-6	IV/13;VI/11;VII/56	1-2-6	~~Private~~ SOLD

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County	Twp	Range	Sec	Subdivision	Acres	General Land Character	AUMs	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
Fergus	19N	17E	21	SE¼SE¼	40.00	Strongly rolling grassland.	9	1-4	VI/13;VII/27	1-4	Private
Fergus	19N	17E	22	SE¼NW¼	40.00	Strongly rolling grassland.	7	1-4	VII/40	1-4	Private
Fergus	19N	17E	25	NW¼NW¼	40.00	Strongly rolling grassland	9	1-4	VII/40	1-4	Private
Fergus	19N	17E	26	NE¼NE¼	40.00	Strongly rolling grassland.	9	1-4	VII/40	1-4	Private
Fergus	19N	17E	27	SW¼NW¼	40.00	Strongly rolling grassland.	8	1-4	VII/40	1-4	Private
Fergus	19N	19E	2	Lot 3	39.51	Mod.rolling grassland.	10	1-4	VII/40	1-4	Public
Fergus	19N	19E	2	SW¼SE¼;SE¼SW¼	80.00	Mod.rolling grassland and sagebrush.	19	1-4	VI/38;VII/42	1-4	Public
Fergus	19N	19E	3	NE¼SW¼	40.00	Mod.rolling grassland and sagebrush.	8	1-4	VII/40	1-4	Private
Fergus	19N	19E	13	SE¼NE¼;NE¼SE¼	80.00	Strongly rolling grassland.	19	1-4	VII/80	1-4	Private
Fergus	19N	23E	12	SW¼NW¼	40.00	Mod.rolling sagebrush	8	1-4	VI/40	1-4	Private
Fergus	19N	23E	30	Lots 1,2	76.12	Steeply rolling grassland.	15	1-4	VII/76	1-4	Public
Fergus	19N	24E	12	NE¼SW¼	40.00	Steeply sloping sagebrush	9	1-4	VII/40	1-4	Private
Fergus	19N	24E	20	NW¼	160.00	Steeply sloping sagebrush	35	1-4	VII/160	1-4	Private
Chouteau	20N	8E	1	Lots 3-4;W½SW¼;NE¼SW¼	122.36	Strongly to very steeply rolling grassland & conifer	14	1-4-6	VII/122	1-4-6	Public
Chouteau	20N	8E	2	E½SE¼;Lots 1-4	82.88	Strongly to very steeply rolling grassland & conifer	13	1-4-6	VII/83	1-4-6	Public
Chouteau	20N	8E	2	SE¼SW¼	40.00	Strongly to very steeply rolling grassland & conifer	5	1-4-6	VII/40	1-4-6	Public
Chouteau	20N	10E	2	Lot 2	30.09	Gently to strongly rolling sagebrush.	6	1-4	VII/30	1-4	Private
Chouteau	20N	10E	5	Lots 1-2;S½SE¼	139.26	Gently to very steeply rolling sagebrush & browse-shrub	37	1-4-6	VII/139	1-4-6	Private
Chouteau	20N	10E	6	Lot 3	28.18	Strongly to very steeply rolling grassland & sagebrush	4	1-4	VII/28	1-3-4	Private
Chouteau	20N	10E	10	SE¼NW¼	40.00	Mod. to steeply rolling browse-shrub	12	1-4	VII/40	1-3-4	Private
Chouteau	20N	10E	15	NW¼NE¼	40.00	Mod.to very steeply rolling grassland & waste	5	1-4	VII/32:VIII/8	1-4	Public
Chouteau	20N	10E	22	NE¼NE¼	40.00	Mod.to steeply rolling grassland.	7	1-4	VII/40	1-4	Public
Chouteau	20N	10E	23	N½SE¼;S½NE¼;NE¼NE¼	200.00	Mod. to very steeply rolling waste,grassland & sagebrush	23	1-4	VII/174:VIII/26	1-4	Public
Chouteau	20N	10E	24	W½NW¼;NW¼SW¼	120.00	Mod. to very steeply rolling waste,grassland & sagebrush	11	1-4	VII/76:VIII/44	1-4	Public
Fergus	20N	17E	13	SW¼NE¼	40.00	Gentle to strong sloping grassland.	6	1-4	VI/7:VII/33	1-4	Private
Fergus	20N	20E	11	S½SE¼;SE¼SW¼	120.00	Strongly rolling conifer	13	1-4-6	VII/120	1-4-6-7	Private
Fergus	20N	20E	13	NE¼NE¼	40.00	Strongly rolling conifer	11	1-4-6	V/33:VII/7	1-4-6-7	Public
Fergus	20N	20E	13	SE¼SE¼	40.00	Strongly rolling conifer	6	1-4-6	VII/40	1-4-6-7	Public

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County	Twp	Range	Sec	Subdivision	Acres	General Land Character	AUMs	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
Fergus	20N	20E	14	W½NW¼	80.00	Strongly rolling conifer.	9	1-4-6	VII/80	1-4-6-7	Private
Fergus	20N	20E	15	E½NE¼	80.00	Strongly rolling conifer.	9	1-4-6	VII/80	1-4-6-7	Private
Fergus	20N	20E	30	SE¼SE¼;NW¼SE¼	80.00	Strongly rolling grassland and conifer.	16	1-4-6	VII/80	1-4-6-7	Private
Fergus	20N	20E	31	Lot 1	40.00	Strongly rolling conifer.	8	1-4-6	VII/40	1-4-6-7	Private
Fergus	20N	20E	31	Lot 7	49.85	Strongly rolling grassland.	9	1-4-6	VII/50	1-4-6	Private
Fergus	20N	21E	6	Lot 17	32.90	Strongly rolling conifer.	3	1-4-6	VII/33	1-4-6-7	Private
Chouteau	21N	9E	5	Lot 2	41.20	Nearly level to gently rolling grassland.	12	1-6	VII/41	1-6	Private
Chouteau	21N	9E	8	SE¼NE¼	40.00	Nearly level to very steeply rolling grassland.	8	1-6	VII/40	1-6	Private
Chouteau	21N	9E	13	Lots 1,3,4;SE¼NE¼;SE¼SW¼	205.03	Steeply to very steeply rolling conifer.	15	1-4	VII/205	1-4	Private
Chouteau	21N	9E	20	N½S½;E½NW¼;SW¼NE¼	280.00	Gently to very steeply rolling grassland,sagebrush & conifer.	21	1-4-6	VII/145;VIII/135	1-4-6	Public
Chouteau	21N	9E	22	SE¼SE¼	40.00	Strong to very steeply rolling sagebrush & conifer.	4	1-4-6	VII/40	1-4-6	Private
Chouteau	21N	9E	22	SE¼SW¼	40.00	Strongly to very steeply rolling sagebrush & conifer.	4	1-4-6	VII/40	1-4-6	Private
Chouteau	21N	9E	24	Lots 1-2;W½SE¼;SW¼NE¼	182.49	Steeply to very steeply rolling conifer.	13	1-4	VII/182	1-4	Private
Chouteau	21N	9E	25	NE¼SW¼;Lots 2,6,7	167.40	Steeply to very steeply rolling conifer	12	1-4	VII/167	1-4	Private
Chouteau	21N	9E	27	SW¼NW¼;W½SW¼	120.00	Mod. to very steeply rolling sagebrush and conifer.	12	1-4-6	VII/104;VIII/16	1-4-6	Private
Chouteau	21N	9E	28	NE¼SE¼	40.00	Mod. to very steeply rolling sagebrush and conifer.	4	1-4-6	VII/31;VIII/9	1-4-6	Private
Chouteau	21N	9E	29	SE¼SE¼	40.00	Gently to very steeply rolling conifer.	2	1-4-6	VII/40	1-4-6-7	Private
Chouteau	21N	9E	31	SW¼SW¼	40.00	Strong to very steep sloping grassland & conifer.	4	1-4-6	VII/40	1-4-6	Public
Chouteau	21N	10E	18	NW¼SE¼	40.00	Gently to steeply rolling sagebrush.	5	1-4-6	VII/40	1-4-6	Private
Chouteau	21N	10E.	27	SE¼NE¼	40.00	Nearly level to very steeply rolling grassland.	12	1-6	VII/40	1-6	Private
Chouteau	21N	10E	32	SE¼NW¼	40.00	Gently to strongly rolling conifer.	8	1-4-6	VII/40	1-4-6	Private
Chouteau	21N	11E	17	Lot 6	28.91	Nearly level to mod.rolling grassland.	10	1-3-4-6	IV/29	1-3-4-6	Public
Chouteau	21N	11E	18	Lot 3	15.10	Nearly level to mod.rolling grassland.	10	1-3-4-6	IV/15	1-3-4-6	Public
Chouteau	21N	11E	19	Lot 2	46.67	Gently to steeply rolling grassland.	7	1-3-4-6	VII/47	1-3-4-6	Public
Chouteau	21N	11E	20	Lot 2	12.87	Nearly level to gently rolling grassland.	5	1-3-4-6	IV/13	1-3-4-6	Public
Chouteau	21N	11E	21	NE¼NW¼	40.00	Gently to steeply rolling grassland.	11	1-2-6	IV/8;VII/32	1-2-6	Private
Chouteau	21N	11E	21	SW¼SE¼	40.00	Gently to steeply rolling grassland.	9	1-2-6	IV/10;VII/30	1-2-6	Private
Fergus	21N	17E	27	SE¼SW¼	40.00	Strong sloping grassland.	8	1-4	VII/40	1-4	Private

County	Twp	Range	Sec	Subdivision	Acres	General Land Character	AUMs	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
Fergus	21N	17E	33	SE¼NW¼;SW¼NE¼;NW¼SE¼	120.00	Steep sloping sage & grassland	15	1-4	VI/31;VII/89	1-4	Private
Fergus	21N	18E	1	Lots 3-4	81.20	Steep sloping grassland.	13	1-4	VII/81	1-4	Private
Fergus	21N	20E	23	NE¼NW¼	40.00	Mod. rolling conifer	8	1-6-9	VII/40	1-6-9	Public
Fergus	21N	20E	25	NE¼SE¼	40.00	Mod.rolling grassland & conifer	7	1-4-6	VII/40	1-4-6	Private
Fergus	21N	20E	25	S½SW¼	80.00	Mod.rolling grassland & conifer	14	1-4-6	VII/80	1-4-6	Private
Fergus	21N	20E	26	NW¼SW¼	40.00	Mod. rolling grassland	8	1-4-6	VII/40	1-4-6	Public
Fergus	21N	20E	27	NE¼SE¼	40.00	Mod. rolling grassland.	8	1-4-6	VII/40	1-4-6	Public
Fergus	21N	21E	5	NW¼SE¼	40.00	Mod. rolling sagebrush	9	1-4	VII/40	1-4	Private
Fergus	21N	21E	6	Lot 6	38.56	Mod. rolling grassland	6	1-4	VII/39	1-4	Public
Fergus	21N	21E	7	Lot 4	38.77	Mod. rolling grassland	11	1-4	VII/39	1-4	Public
Fergus	21N	21E	11	NE¼SW¼	40.00	Mod. rolling grassland	14	1-4	VII/40	1-4	Private
Fergus	21N	21E	17	NW¼NE¼	40.00	Mod. rolling grassland	8	1-4	VII/40	1-4	Private
Fergus	21N	21E	30	E½NW¼	80.00	Mod. rolling grassland and conifer.	14	1-4	VII/80	1-4-7	Public
Fergus	21N	21E	31	Lot 2;SE¼NW¼	79.70	Mod. rolling conifer	13	1-4	VII/80	1-4-7	Private
Chouteau	22N	9E	2	SW¼SE¼	40.00	Gently to steeply rolling grassland.	9	1-6	VII/40	1-6	Private
Chouteau	22N	9E	11	NW¼NE¼	40.00	Gently to steeply rolling grassland.	8	1-6	VII/40	1-6	Private
Chouteau	22N	9E	14	Lot 6	19.13	Gently to strongly rolling grassland.	5	1-6	VII/19	1-6	Private
Chouteau	22N	9E	23	Lot 2	26.54	Gently to strongly rolling grassland.	6	1-6	VII/27	1-6	Private
Chouteau	22N	9E	33	SW¼NW¼	40.00	Nearly level to gently rolling grassland.	12	1-6	VII/40	1-6	Private
Chouteau	22N	10E	23	Lots 1,4,5	34.02	Nearly level to gently rolling meadow.	16	1-6	IV/34	1-2-6	Private
Chouteau	22N	10E	26	Lot 4	12.70	Nearly level to gently rolling meadow.	6	1-6	IV/13	1-6	Private
Chouteau	22N	13E	4	NW¼SE¼	40.00	Nearly level grassland.	8	1-6	IV/14:VI/26	1-6	Private
Chouteau	22N	14E	20	NE¼NE¼	40.00	Gently to strongly rolling grassland.	13	1-6	VI/40	1-4-6	Public
Fergus	22N	18E	35	NW¼SE¼;lots 3,4	122.30	Steep sloping grassland.	14	1-4	VII/122	1-4	Private
Fergus	22N	19E	9	W½NE¼	80.00	Mod. rolling grassland.	17	1	VII/80	1	Private
Fergus	22N	19E	20	NE¼NE¼	40.00	Strongly rolling grassland.	7	1	VII/40	1	Private
Fergus	22N	19E	21	SW¼	160.00	Strongly rolling grassland.	30	1	VI/30:VII/130	1	Private
Fergus	22N	20E	4	SE¼SW¼	40.00	Mod. rolling grassland.	8	1	VII/40	1	Private

Appendix A Continued

County	Twp	Range	Sec	Subdivision	Acres	General Land Character	AUMs	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
Fergus	22N	20E	5	SE¼SE¼	40.00	Mod. rolling grassland	8	1	VII/40	1	Private
Fergus	22N	20E	12	NW¼;SE¼;N½NE¼;SE¼NE¼	440.00	Mod. rolling grassland	111	1	VI/440	1	Private
Fergus	22N	20E	15	NW¼NW¼	40.00	Mod. rolling grassland	7	1	VII/40	1	Private
Fergus	22N	20E	20	NW¼NE¼;S½NE¼	120.00	Mod. rolling grassland	36	1	VII/120	1-9	Public
Fergus	22N	20E	22	NW¼NE¼	40.00	Strongly rolling grassland	10	1	VII/40	1	~~Private~~ SOLD
Fergus	22N	20E	22	SE¼NE¼	40.00	Strongly rolling grassland	10	1	VII/40	1	~~Private~~ SOLD
Fergus	22N	20E	23	NW¼SE¼;NE¼SW¼	80.00	Strongly rolling grassland	14	1	VII/80	1	~~Private~~ SOLD
Fergus	22N	20E	27	NE¼NE¼	40.00	Gently rolling grassland	7	1	VII/40	1	~~Private~~ SOLD
Fergus	22N	20E	35	S½SE¼	80.00	Strongly rolling grassland	20	1	VII/80	1	Public
Fergus	22N	21E	4	NE¼SW¼;S½SW¼	120.00	Strongly rolling conifer	27	1	VII/120	1	Private
Fergus	22N	21E	5	S½SE¼	80.00	Strongly rolling conifer	18	1	VII/80	1	Private
Fergus	22N	21E	7	Lot 2	36.34	Mod. rolling grassland	9	1	VI/36	1	Private
Fergus	22N	21E	7	SW¼SE¼;SE¼SW¼	80.00	Mod. rolling conifer	18	1	VII/80	1	Private
Fergus	22N	21E	9	N½NW¼	80.00	Strongly rolling conifer.	18	1	VII/80	1	Private
Fergus	22N	21E	9	SE¼SE¼	40.00	Strongly rolling conifer.	9	1	VII/40	1	Private
Fergus	22N	21E	17	NW¼SE¼;S½SE¼	120.00	Mod. to strongly rolling conifer.	24	1	V/11:VII/109	1	Private
Fergus	22N	21E	18	NE¼SW¼	40.00	Gentle sloping grassland.	9	1	VI/40	1	Private
Fergus	22N	21E	19	E½NE¼	80.00	Mod. rolling conifer	18	1	VII/80	1	Private
Fergus	22N	21E	20	N½N½	160.00	Mod.to strongly rolling conifer	31	1	VII/160	1	Private
Fergus	22N	21E	29	SW¼	160.00	Mod. rolling grassland	45	1	VII/160	1	Private
Fergus	22N	21E	30	SE¼	160.00	Mod. rolling grassland	45	1	VII/160	1	Private
Chouteau	23N	10E	14	SW¼SW¼	40.00	Hayland and submerged	24	1-2-6	III/29:VIII/11	1-2-6	Private
Fergus	23N	16E	34	NW¼NE¼	40.00	Nearly level grassland	8	1	VI/40	1-3	Public
Fergus	23N	16E	34	N½SE¼	80.00	Nearly level grassland	17	1	VI/80	1	Private
Fergus	23N	20E	31	Lots 1-2:NE¼NW¼	117.43	Mod. rolling grassland	29	1	VII/117	1	~~Private~~ SOLD
Fergus	23N	20E	33	SW¼SE¼	40.00	Strongly rolling grassland	9	1	VI/40	1	Private
Chouteau	24N	10E	4	SW¼NW¼	40.00	Nearly level to steeply rolling sagebrush & grassland	3	1-2-6	IV/7 :VII/33	1-2-6	Public
Chouteau	24N	10E	20	NE¼SE¼	40.00	Gently to mod. rolling grassland.	10	1-6	VI/40	1-6	Private

Appendix A Continued

County	Twp	Range	Sec	Subdivision	Acres	General Land Character	AUMs	Present Land Use	Land Capability Classification	Principal Suitability	Proposed Management
Chouteau	24N	11E	5	Lot 4	45.23	Gentle to steep rolling grassland	8	1-6	VII/45	1-6	Public
Chouteau	24N	13E	20	SW¼SW¼	40.00	Gently rolling grassland.	13	1-4	VI/40	1-4	Public
Chouteau	25N	10E	11	SE¼NW¼	40.00	Nearly level to strongly rolling grassland.	12	1-4	VI/40	1-4	Public
Chouteau	25N	10E	12	SE¼NE¼;NE¼SE¼	80.00	Nearly level to steeply rolling grassland	23	1-4	VI/35:VII/45	1-3-4	Public
Chouteau	25N	10E	27	SW¼NW¼	40.00	Nearly level to steeply rolling grassland.	7	1-6	VII/40	1-6	Public
Chouteau	25N	10E	29	Lot 4	3.00	Island - rocky, gravel bar	0	4-10	VIII/3	3-4-10	Public
Chouteau	25N	10E	29	Lot 5	6.62	Nearly level rangeland with broadleaf trees.	2	1-4	IV/7	1-3-4	Public
Chouteau	25N	10E	34	NE¼SW¼	40.00	Nearly level to steeply rolling grassland.	11	1-4	VI/40	1-4	Public
Chouteau	25N	11E	6	E½SW¼	80.00	Nearly level to steeply rolling grassland	23	1-4	VI/37:VII/43	1-3-4	Public
Chouteau	25N	11E	7	Lot 3	39.03	Nearly level to steeply rolling grassland.	12	1-6	VI/10:VII/29	1-3-6	Public
Chouteau	25N	11E	23	NE¼NE¼	40.00	Mod. rolling grassland.	12	1-6	VI/40	1-6	Private
Chouteau	25N	12E	2	Lots 2-3;SW¼NE¼	120.68	Gently to steeply rolling grassland.	22	1-6	VII/121	1-6	Private
Chouteau	25N	12E	9	SE¼NW¼;SW¼NE¼;E½SW¼;W½SE¼; SE¼SE¼	280.00	Nearly level to steeply rolling grassland.	47	1-2-6	VI/79:VII/201	1-2-6	Private
Chouteau	25N	12E	10	NW¼SW¼;SE¼SW¼;S½SE¼	160.00	Nearly level to steeply rolling grassland.	28	1-2-6	VI/60:VII/100	1-2-6	Private
Chouteau	25N	12E	11	SE¼SW¼	40.00	Strongly to steeply rolling grassland.	7	1-2-6	VII/40	1-2-6	Private
Chouteau	25N	12E	14	N½N½;SW¼NE¼	240.00	Nearly level to steeply rolling grassland	28	1-2-6	VI/95:VII/145	1-2-6	Private
Chouteau	26N	11E	14	SW¼SE¼	40.00	Nearly level to steeply rolling grassland	7	1-2-6	VI/20:VII/20	1-2-6	Private
Chouteau	26N	11E	23	SE¼NW¼;NW¼SW¼;NW¼SE¼	120.00	Nearly level to steeply rolling grassland	19	1-6	VI/59:VII/61	1-6	Public
Chouteau	26N	12E	3	SE¼SW¼;SW¼SE¼	80.00	Gently to steeply rolling grassland.	9	1-4	VII/80	1-4	Public
Chouteau	26N	12E	35	N½NE¼	80.00	Nearly level to steeply rolling greasewood and grassland	14	1-6	V/33:VI/3:VII/44	1-6	Public
Wheatland	9N	12E	12	NE¼NW¼	40.00	Moderately rolling grassland	17	1-4	VI/40	1-4	Private
Wheatland	9N	12E	20	NW¼SE¼	40.00	Gently rolling grassland	7	1-4	VI/40	1-4	Private
Wheatland	9N	12E	28	S½NW¼	80.00	Gently rolling grassland	14	1-4	VII/80	1-4	Private
Wheatland	9N	12E	32	NE¼SE¼;SE¼NE¼	80.00	Nearly level grassland	11	1-4	VI/80	1-4	Private
Wheatland	9N	15E	6	SE¼NE¼	40.00	Gently to moderately rolling grassland	10	1-4	VI/40	1-4	Public
Wheatland	9N	18E	22	NW¼	160.00	Moderately rolling sagebrush	29	1-4	VII/160	1-4	Private
Wheatland	9N	18E	26	W½W½;SE¼NW¼;NE¼SW¼	240.00	Strongly rolling grassland	50	1-4	VII/240	1-4	Private

APPENDIX B

Section 1	Early Journals Describing Vegetation, Wildlife, Water and Erosion
Section 2	Photographic Comparisons for Trend
Section 3	Erosion - Piping
Section 4	Plant Frequencies
Section 5	Land Classification Reconnaissance
Section 6	Potential Natural Vegetation

APPENDIX B, Section 1

Early Journals Describing Vegetation, Wildlife, Water and Erosion

Several reliable accounts of early day natural history in the Musselshell subbasin are available as a background comparison for current conditions. The U.S. Army conducted most of the explorations to evaluate newly acquired territory, and search for travel routes.

The first formal record is that produced by Captains Meriwether Lewis and William Clark, acting under direction of President Thomas Jefferson. During 1805 they travelled upstream, toward the Pacific, returning eastward in 1806.

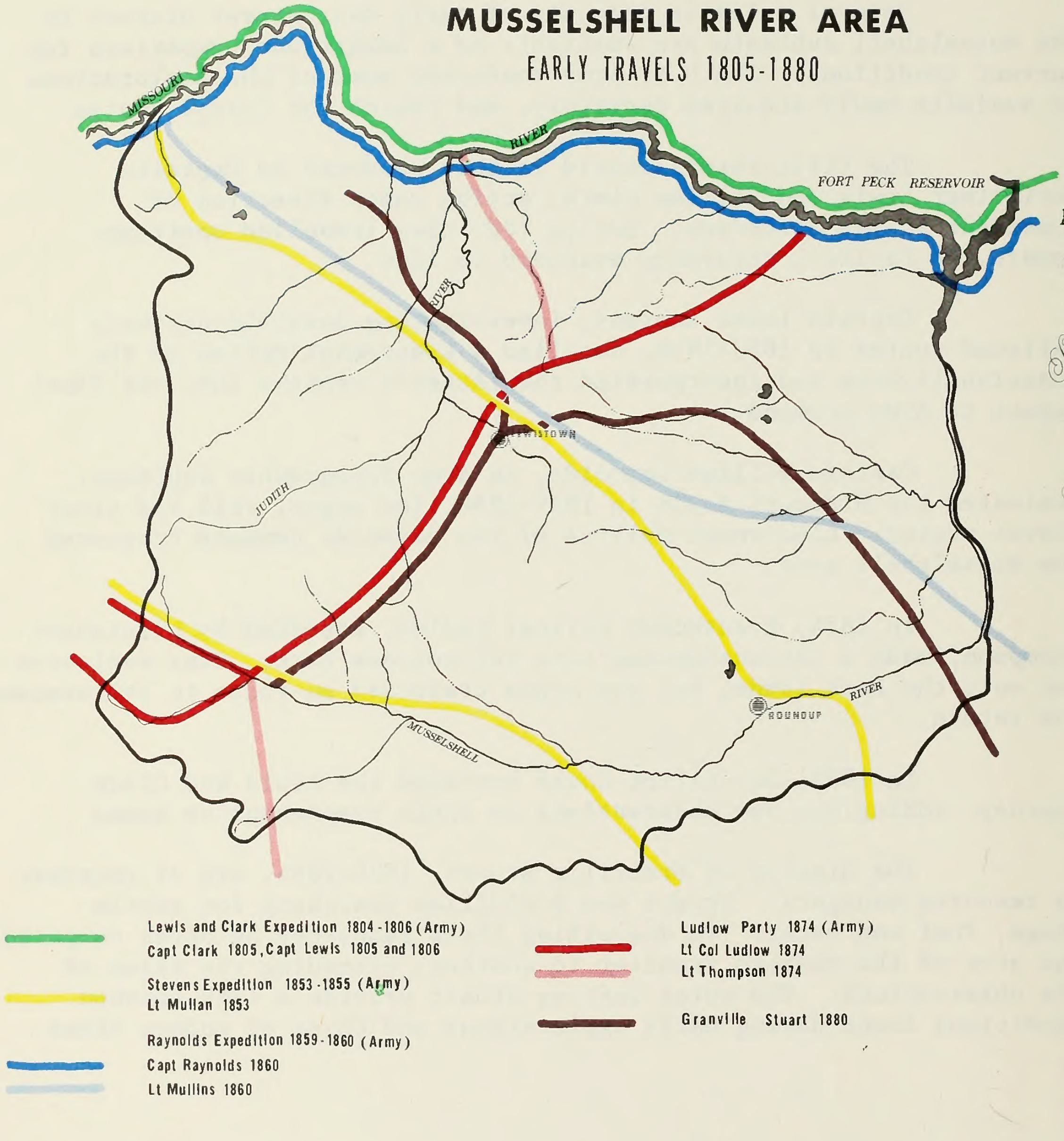
Captain Isaac Stevens, investigating possible northern railroad routes in 1853-1856, detailed a Lieutenant Mullan to the Musselshell area and incorporated the latter's remarks into the final report to Army Command.

Captain William Raynolds, an Army Topographic Engineer, evaluated the Missouri Basin in 1859-1860, for wagon, rail and river travel routes. Lieutenant Mullins of the Raynolds command traversed the Musselshell area.

In 1874, Lieutenant Colonel Ludlow, assisted by Lieutenant Thompson, made a reconnaissance into Yellowstone Park. They evaluated not only the Park lands, but the areas traversed en-route to Yellowstone and return.

In 1875, Dr. Elliot Coues retraced the Lewis and Clark journey, adding his own observations to their comprehensive notes.

The diaries of Granville Stuart, 1880-1884, are of interest to resource managers. Stuart was a civilian searching for cattle range, fuel and water. In describing these resources he often compared one area of the western frontier to another, extending the value of his observations. The notes left by Stuart provide a link between conditions found during early explorations and those of modern times.



MUSSELSHELL RIVER AREA

EARLY TRAVELS 1805-1880

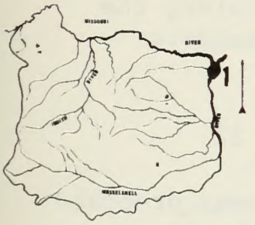
AREA 1 1805 Lewis and Clark Expedition May 20

At its mouth the Musselshell had more water than most of the local streams. Its mouth was 110 yards wide with banks rising nearly twelve feet:

> "...the water is of a greenish-yellow cast; and much more transparent than that of the Missouri, which itself, though clearer than below, still retains its whitish hue and a portion of its sediment."

1860 Raynolds Expedition July 27

Raynolds' notes were:



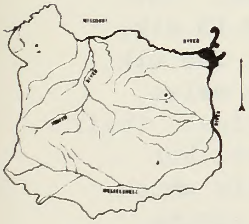
> "The Musclschell, at its mouth, gives no evidence of draining the immense region it does, as it is not more than 30 feet wide and one or two feet deep at this point, its banks being muddy and the bed of the stream, therefore, difficult to cross. Its valley is wide and well covered with young cottonwood trees. It is a favorite resort for the Indians, a large band of whom have but just left it."

AREA 2 1805 Lewis and Clark Expedition May 21

Rangeland opposite the Musselshell mouth - north of the river had:

> "...a fertile soil which, though without wood, produces a fine turf of low grass, some herbs, and vast quantities of prickly pear...."

Of the Musselshell Area:



> "The country on the south is high, broken, and crowned with some pine and dwarf cedar;....
> "During the whole day the bends of the river are short and sudden; the points are covered with some cottonwood, large or broad-leaved willow, and a small quantity of redwood; the undergrowth consisting of wild roses and the bushes of the small honeysuckle."

That day they shot elk, deer and buffalo.

1860 Raynolds' Expedition July 26

Raynolds found some game to be plentiful, but buffalo were scarce:

> "...to-day deer and elk have been started at almost every turn of the river. A few buffalo bulls have also been visible, but no large bands, notwithstanding the fact that a few years since this was one of their great feeding grounds."

Of vegetation and the silt load of the Missouri River:

> "...the water is fast taking on its proverbially muddy appearance. The valleys widens and contains more timber, while the immediate river banks are sharply cut and perpendicular, the atrata showing the deposits of successive overflows."

AREA 3 1805 Lewis and Clark Expedition May 22

At Beauchamps Creek the name "Grouse Creek" was proposed because of the great quantity of sharp-tailed grouse. Lewis described the range land:

> "The low grounds are somewhat wider than usual, and apparently fertile, though the short and scanty grass on the hills does not indicate much richness of soil."

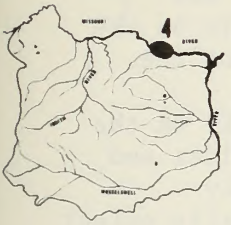
1806 Lewis and Clark Expedition July 31

Lewis: (Biddle's 1814 text)

> "July 31st, continued our route in the rain, passing, during the greater part of the day, through high pine hills, succeeded by low grounds abounding in timber and game. The buffalo are scarce, but we procured 15 elk, 14 deer, 2 bighorns, and a beaver. The elk are in fine order, particularly the males, who now herd together in small parties. Their horns have reached their full growth, but ill [still] retain the velvet or skin which covers them. ...The river is still rising, and more muddy than we have ever seen it."

AREA 4 1805 Lewis and Clark Expedition May 23

Lewis of Teapot Creek:



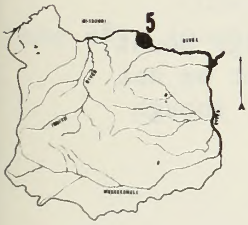
> "...this I believe to be the case with many of those creeks which we have passed since we entered this hilley country, the water is absorbed by the earth near the river and of course appear dry; they afford but little water at any rate, and that is so strongly impregnated with these salts that it is unfit for uce;...."
> "...just above the entrance of Teapot Creek on the star^{d}. there is a large assemblage of the burrows of the Burrowing Squirrel...."

AREA 5 1805 Lewis and Clark Expedition May 24

The expedition found:

> "...a large village of the burrowing or barking squirrels on the Star^{d}. side...."

Lewis wrote of Area 5:



> "...The country high and broken, a considerable portion of black rock and brown sandy rock appear in the faces of the hills; the tops of the hills covered with scattering pine spruce and dwarf cedar; the soil poor and sterile, sandy near the tops of the hills, the whole producing but little grass; the narrow bottoms of the Missouri producing little else but Hysop or southern wood and the pulpy leafed thron."

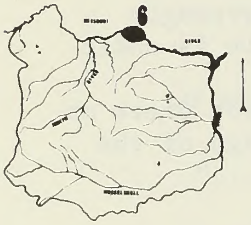
Lewis observed:

> "...game is becoming more scarce, particularly beaver, of which we have seen but a few for several days the beaver appears to keep pace with the timber as it declines in quantity they also become more scarce."

AREA 6 1805 Lewis and Clark Expedition May 25

The first description of the Bighorn sheep was made on May 25. Lewis:

> "...as we ascended the river today I saw several gangs of the bighorned Anamals on the face of the steep bluffs and clifts on the. Star^d. side....



> "...they feed on grass but principally on the arromatic herbs which grow on the clifts and inaccessable hights which they usually frequent. the places they ge [ne]rally celect to lodg is the cranies or c [r]evices of the rocks in the faces of inacessable precepices, where the wolf nor bear can reach them....
> "...The Country on either hand is high broken and rockey;...the river bottoms are narrow and afford scarcely any timber. the bars of the river are composed principally of gravel, but little pine on the hills."

After recording seeing a skunk, the first one in many days, Clark repeated his observation on the scarcity of buffalo.

Clark was the first white man to sight the Rocky Mountains:

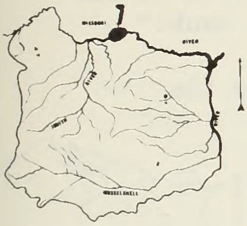
> "...I also think I saw a range of high Mount^s. at a great distance to the S S W. but am not certain as the horozon was not clear enough to view it with certainty."

1860 Raynolds found:

> "Below Cow island, however, a change took place in the nature of the country. The hills, whose sides and summits are covered with pine, recede, forming a well-defined bottom, in which cottonwood trees in small quantities again appear. There is thus abundant fuel at this point along the river banks, while many of the pines would furnish passable lumber. Navigation is, however, embarrassed by numerous rapids, and for a voyage up stream it would be indispensable to have vessels of light draft and strong motive power. At low water no vessel drawing over 18 inches could pass. Navigation would also be decidedly improved by the removal of a number of large boulders from the river's bed."

AREA 7 1805 Lewis and Clark Expedition May 26

Clark climbed the steep hills beside the Missouri to check his sighting, on May 25, of the Rocky Mountains:



> "...I crossed a Deep holler and assended a part of the plain elivated much higher than where I first viewed the above Mountains; from this point I beheld the Rocky Mountains for the first time with certainity,...."
> "...I saw a great number of white brant, also the common brown brant, Geese of the common size & kind and a small Species of gees, which differs considerably from the common or Canadian Goose;...."

Lewis reported of Clark:

> "...he also saw in the course of his walk, some Elk several herds of the Big horn, and the large hare; the latter is common to every part of this open country.

Lewis confirmed sighting the Rockies and saw "a few Elk & bighorns at a distance" noted some softshelled turtles and "killed a fat buffaloe". The hunters killed a couple of Bighorns.

Clark accustomed to large numbers of wild game, wrote of the days journey:

> "...game scerce. this Countrey may with propriety I think be termed the Deserts of America, as I do not conceive any part can ever by settled, as it is deficent in water, Timber & too steep to be tilled...."

1806 Lewis and Clark Expedition July 30

Lewis: (Biddle's 1814 text)

> "We went ashore several times for the purpose of hunting, and procured several bighorns, two buffalo, a beaver, an elk, and a female brown bear, whose talons were 6¼ inches in length."

All bears were grizzlies.

1874 Coues, surgeon and naturalist with the Northern Boundary Survey:

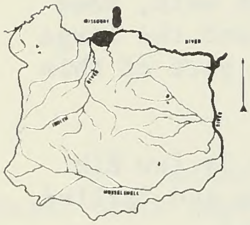
> "While passing down this part of the Missouri in 1874,...found the buffalo and bighorns still very

> abundant. The buffalo were crossing the river, and their alarm at our flotilla of six Mackinaw boats sweeping down the river gave rise to a remarkable scene at a point where the banks were precipitous....
> A herd of several hundred took the alarm at our approach, and rushed headlong up the bank."

Several buffalo were killed trying to climb up the steep slopes.

AREA 8 1805 Lewis and Clark Expedition May 27

Lewis:



> "...the bluffs are very high steep rugged, containing considerable quantities of stone and border the river closely on both sides; once perhaps in the course of several miles there will be a few acres of tolerably level land in which two or thre impoverished cottonwood trees will be seen...
> "This evening we encamped, for the benefit of wood, near two dead toped cottonwood trees on the Lar^{d}. side; the dead limbs which had fallen from these trees furnished us with a scanty supply only, and more was not to be obtained in the neighbourhood."

1860 Raynolds' description of Area 8 on July 25 follows Lewis's:

> "It would apparently be impossible to approach the river from the banks among these "bad lands", and equally impossible to construct a road over them that would withstand the action of the water.

AREA 9 1805 Lewis and Clark Expedition May 28

Clark:

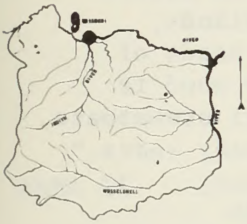
> "...I saw great numbers of the Big horned animals, one of which I killed their fauns are nearly half grown. one of the Party saw a verry large bear,...."

Close to the mouth of the Judith;

> "...at 10 miles the hills begin to widen & the river spreds & is crouded with Islands

> the bottoms contain some scattering cotton wood the Islands also contain timber.

Lewis described the country east of the mouth of the Judith:



> "...the river country &c continued much as yesterday untill late in the evening when we arrived at the entrance of a large Creek
> "...here the hills recede from the river on both sides,....
> "...here also the river spreads to more than 3 times it's former width and is filled with a number of small and handsome Islands covered with cottonwood some timber also in the bottoms, the land again fertile. these appearances were quite reviving after the drairy country through which we had been passing.
> "...I believe the bighorn have their young at a very early season, say early in March, for they appear now to be half grown."

1805 Lewis and Clark Expedition May 29

On the following day, 2½ miles up the river, the party reached the mouth of the Judith River. Lewis at the Judith River:

> "I found this river about 100 y^{ds}. wide from bank to bank, the water occupying about 75 yar^{ds}.... it appeared to contain much more water as the Muscle-Shell river,...the water of this River is clearer much than any we have met with great abundance of the Argalia or Bighorned animals in the high country through which this river passes.
> "the bottoms of this stream as far as I could see were wider and contained more timber than the Missouri; here I saw some box alder intermixed with the Cottonwood willow; rose bushes and honeysuckle with some red willow constitute the undergrowth."

1874 Ludlow Party September 13

Lt. Thompson camped at the Judith's mouth for several days. Four miles up from the mouth of the river he wrote:

> "...Camped on the river; abundance of wood; grazing poor.
> "The Judith is a swift-running stream.... Its sources in the Judith Mountains are clear,

cold spring, but the character of the water changed completely in its course to the Missouri. Its temperature is very much increased, and a considerable amount of earthy matter is taken up and held in suspension. Though all its upper branches are plentifully stocked with trout, none of these fish were taken in the main stream. Its valley proper, from bluff to bluff, is about a mile wide, well timbered with a young growth of cottonwood. Scrub pines and cedars are sparsely scattered over the highlands, principally on the sides and at the heads of ravines. From the rate at which the wood is now being taken out for the supply of steamboats, the whole will be exhausted before many years."

AREA 10 1805 Lewis and Clark Expedition May 30

The Missouri was growing clearer but the way was extremely difficult, the boats were towed along steep, slippery banks.

Lewis:

"...the country was level a little back from the river on both sides. there is now no timber on the hills, an only a few scattering cottonwood, ash, box Alder and willows to be seen along the river."

1805 Lewis and Clark Expedition May 29

The expedition just below Arrow Creek, passed a buffalo jump where over 100 buffalo had died. Wolves, fat and extremely gentle were in large numbers. Clark killed one with his espontoon (a halberd-like weapon carried by line officers.) Arrow Creek had a narrow bottom with little timber. The hunters killed an elk and Clark two beavers.

1806 Lewis and Clark Expedition returning eastward July 29

Lewis: (Biddle's 1814 text)

"The two small canoes were sent ahead in order to hunt elk and buffalo, which are in immense quantities, so as to provide shelter as well as food for the party. We then proceeded very rapidly with the aid of a strong current, and after passing, at one o'clock, the Natural Walls, camped late in the evening at our former camp of the 29th of May, 1805. The river is now

> as high as it has been during the present season, and every little rivulet discharges torrents of water, which bring down such quantities of mud and sand that we can scarcely drink the water of the Missouri. The buffalo continue to be very numerous, but the elk are few. The bighorns, however, are in great numbers along the steep cliffs of the river, and being now in fine order, their flesh is extremely tender, delicate, and well-flavored, resembling in color and flavor mutton, though it is not so strong. The brown curlew (Numenius longirostris) has disappeared, and has probably gone to some other climate after rearing its young in these plains."

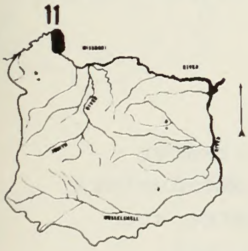
AREA 11 1805 Lewis and Clark Expedition May 31

Lewis wrote nearly 1,000 words about the white cliffs, now a major scenic attraction along the Missouri and a valued part of the proposed Lewis and Clark National Waterway.

Lewis discovered and described limber pine (Pinus flexilis) and:

> "...we saw a great number of the Bighorn some mule deer and a few buffaloe and Elk, no antelopes or common deer. Drewyer who was with me and myself killed two bighorned anamals; the sides of the Clifts where these anamals resort much to lodg, have the peculiar smell of the sheepfolds."

Clark, of Eagle Creek:



> "...bold stream of clear water....
> "...in the evening the contrey becomes lower and the bottoms wider, no timber on the uplands, except a few cedar & pine on the clifts a few scattering cotton trees on the points in the river bottoms. The appearance of coal continues ...black earth.... we saw Great numbers of those big horned animals on the clifts, but fiew Buffalow or Elk, no antelope, a fiew mule deer, saw a fox to day."

1860 Captain Raynolds noted:

> "The sandstone...has been thus cut into all conceivable shapes, picturesque and grotesque. ...these take on an endless variety of fanciful appearances, resembling in turn massive temples, vast colonnades, fortifications of Titanic origin,

> or any of the mightier reliques of remote antiquity.
>
> "In some points the sandstone is broken by dikes of trap like immense rocky walls piled up by human skill. One was full 100 feet in height and 400 feet in length, and another was... a distinct and nearly perfect horseshoe. These extraordinary freaks of nature have surrounded us on both sides during our voyage to-day, and in point of scenery the journey has been exceedingly pleasant."

AREA 12 1805 Lewis and Clark Expedition June 1

Lewis:

> "...the river Clifts and bluffs not so high as yesterday and the country becomes more level. ...Cap. C. who walked on shore today informed me that...he observed large banks of pure sand which appeared to have been d [r] iven by the S. W. winds from the river bluffs and there deposited."

There was much more timber (cottonwoods) on the river and the islands but none on the highlands. Game was sparse although buffalo were seen about 8 miles distant and one bighorn and one mule deer were killed.

Lewis:

> "...I saw the choke cherry the yellow and red courant bushes; the wild rose appears now to be in full bloom as are also the prickly pear which are numerous in these plains."

Clark:

> "...The roses are in full bloom, I observe yellow berries, red berry bushed Great numbers of Wild or choke Cheries, prickly pares are in blossom & in great numbers."

AREA 13 1805 Lewis and Clark Expedition June 4

Lewis ascended the Marias River (Conditions there are similar to the Musselshell Area which joins it).

Lewis:

> "...I now directed my course through a high

> level dry open plain...the soil appears dark rich and fertile yet the grass is by no means as high nor does it look so luxurient as I should have expected, it is short just sufficient to conceal the ground. great abundance of prickly pears which are extreemly troublesome; as the thorns very readily perce the foot through the Mokerson; they are so numerous that it requires one half of the traveler's attention to avoid them,...."

Curlews, three kinds of sparrows and lark buntings were nesting in great numbers on the ground. Of the last, 30 or 40 would be singing in the air at one time.

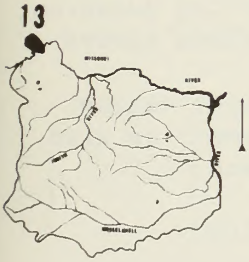
> "there are meriads of small grasshoppers in these plains which no doubt furnish the principal aliment of this numerous progeny of the feathered creation."

They shot two deer for breakfast.

> "I killed a braro[1] and a beaver. the river bottoms form one emence garden of roses, now in full bloe."

1805 Lewis and Clark Expedition June 5

Lewis continued up the Marias to what is now Black Coulee:



> "...on this course we passed through the plains found the plains as yesterday extreemly leavel and beautifull, great quantities of Buffaloe, some wolves foxes and Antelopes seen. near the river the plain is cut by deep ravenes in this plain and from one to nine miles from the river or any water, we saw the largest collection of the burrowing or barking squirrels that we had ever yet seen; we passed through a skirt of the territory of this community for about 7 miles:...."

1805 Lewis and Clark Expedition June 6, 7, 8

Lewis decided the Marias was not the Missouri, he began his return. On the 8th:

> "...The river bottoms affording all the timber which is to be seen in the country they are filled with innumerable little birds that resort thither either for shelter or to build their nests. when sun began to shine today these birds appeared to

[1] badger

> be very gay and sung most inchantingly; I observed among them the brown thrush, Robbin, turle dove linnit goaldfinch, the large and small blackbird, wren and several other birds of less note."

Naming the river Maria's River for Maria Wood, he wrote:

> "...it passes through a rich fertile and one of the most beatifully picteresque countries that I ever beheld, through the wide expance of which, innumerable herds of living animals are seen, it's borders garnished with one continued garden of roses.

AREA 14 1805 Lewis and Clark Expedition June 2

The Expedition camped at the mouth of the Marias River. The Marias was high and muddy, the Missouri clear. The two captains preferred to go on up the left or south fork, the men unanimously chose the Marias River because of its familiar muddy tinge which to them established it as the Missouri.

Exploratory trips were necessary.

Lewis Monday June 3rd. 1805

> "This morning early we passed over and formed a camp on the point formed by the junction of the two large river. ...An interesting question was now to be determined; which of these rivers was the Missouri,...
> "...accordingly we dispatched two light canoes with three men in each up those streams; we also sent out several small parties by land...."

Of the Marias:

> "...it's waters run in the same boiling and roling manner which has uniformly characterized the Missouri throughout it's whole course so far; it's waters are of a whitish brown colour very thick and terbid, also characteristic of the Missouri;...."

The true Missouri was:

> "...perfectly transparent runds very rappid but with a smoth unriffled surface it's bottom composed of round and flat smooth stones like most rivers issuing from a mountainous country.... the country in every derection around us was one

> vast plain in which innumerable herds of Buffalow were seen attended by their shepperds the wolves; the solatary antelope which now had their young were distributed over it's face; some herds of Elk were also seen; the verdure perfectly cloathed the ground, the weather was pleasent and fair;...."

About 11 miles above the camp, Lewis writes one party found the Teton River with·

> "...much timber in it's bottoms as either of the larger streams. there are a great number of prickley pears in these plains; the Choke cherry grows here in abundance both in the river bottoms and in the steep ravenes along the river bluffs. saw the yellow and red courants, not yet ripe; also the goosberry which begins to ripen; the wild rose which grows here in great abundance in the bottoms of all these rivers is now in full bloom, and adds not a little to the bea [u] ty of the cenery."

Another party seven miles up the "true" Missouri found the Teton River to be only 100 yards away, it was:

> "...a boald runing stream of about 40 y^{ds}. wide contai [n] ng much timber in it's bottom, consisting of the narrow and wide leafed cotton-wood with some birch and box alder undrgrowth willows rosebushes currents &c. they saw a great number of Elk on this river and some beaver. this plain is covered with low grass & prickley pear, emence number of Prarie dogs or barking squirrels are thro this plain."

1805 June 5

Clark:

> "...we saw 8 buffalow opposit, the [y] made 2 attempts to cross, the water being so swift they could not, about the time we were setting out three white bear approached our camp we killed the three & eate part of one & set out & proceeded on...."

After taking a compass bearing on the Missouri, Clark returned to the Teton River:

> "I saw great numbers of Elk & white tale deer,

> some beaver, antelope mule deer & wolves & one bear on this little river marked my name in a tree N. side near the ridge where the little river brakes thro'...."

1805 Lewis and Clark Expedition June 6

Clark returned down the Teton, which he named Tanzey River:

> "I also observed wind [wild] Tanzey on this little river in great quantities...."

1805 Lewis and Clark Expedition June 12

In the evening:

> "The narrow leafed cottonwood grows here in common with the other species of the same tree... which has constituted the major part of the timber of the Missouri from it's junction with the Mississippi to this place.
> "...the beaver appear to be extremely fond of this tree and even seem to scelect it from among the other species of Cottonwood,.... saw some sign of the Otter as well as beaver near our camp, also a great number of tracks of the brown bear;...."

Clark was moving upstream:

> "...Saw emence N^o of swallows in the 1st bluff on the Lar^d Side, water verry swift,....Saw a number of rattle snakes to day one of the men cought one by the head in catchi^g hold of a bush on which his head lay reclined...."

1805 Lewis and Clark Expedition June 11

Lewis at Crocon du Nez on the river. His party killed four elk Several dozen sand pike and herring-like goldeye were caught.

AREA 15 1805 Lewis and Clark Expedition June 13

Lewis observed of area:

> "...I overlooked a most beatifull and level plain of great extent or at least 50 or sixty miles; in this there were infinitely more buffaloe than I had ever before witnessed at a view."

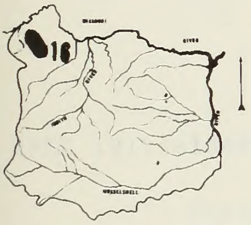
Then, after two miles travel he heard the sound of the Great Falls of the Missouri River and saw the spray. He and Clark had chosen correctly and were on the Missouri!

As he awaited the boat party, he states that grizzly bears whether white, brown or grizzly colour were all the same species. Yesterday of two killed, one was cream white, the other the more common bay or reddish brown. Another was very dark with a broad white stripe entirely around his body behind the shoulders. At that time the party had not seen any grizzle-colored bears. They had seen no black bears in this open country.

Clark passed Shonkin Creek early on the 13th (his goat is a pronghorn):

> "...we call this stream Snow river, as it is the conveyance of the melted snow from that mountain at present. numbers of Gees & Goslings, the gees cannot fly at this season. ...killed a buffalow & camped on the Lar$_{d}$ side near an old Indian fortified camp.... Killed a goat & fraser 2 Buffalow...."

AREA 16 1853 Lieutenant Mullan (Stevens Expedition)



> "Part of the route was along a small, shallow, and winding stream called Shonkee creek;....
> "Grass was luxuriant in its valley, and at its head pines of large size were abundant. The first spurs of the range known as the Highwood are a thousand feet in height, and abundantly wooded."

AREA 17 1853 Lieutenant Mullan (Stevens Expedition)

> "The branches of Arrow river were next crossed near their heads in the mountain spurs, having beautiful valleys, wooded along the stream.
> "Small tracts on some of the branches of the Judith river had the desolate character of the Mauvaises Terres, particularly on Arrow river, where the ravines were perfectly awful to behold, descending to the depth of many hundreds of feet; the cliff black, barren, and destitute of timber,...."

1860 Lieutenant Mullins (Raynolds Expedition) July 21

> "...The character of the country to-day changed gradually, ...from a high, rolling prairie to a rough broken character; soil poor and of a whitish color. About three and a half miles from camp passed two high, round buttes to the south, and distant about five miles. 1/ At five miles

---

1/ Palisade and Square Butte

from camp crossed a dry creek, heavily timbered with cottonwood;...."

He went down the creek to Arrow River.

AREA 18 1853 Lieutenant Mullan (Stevens Expedition)

"The whole country was...a level plateau between the Girdle and Judith mountains, traversed by the numerous branches of Judith river and covered with excellent and high grass. Innumerable herds of buffalo were feeding near the mountains, and the small ponds swarmed with geese and ducks. Near the mountains the streams were always wooded with cottonwood and wild cherry. Cedar grew on the lower bluffs, and the mountains, from their bases upward, were clothed with pitch and yellow pines, attaining a height of seventy-five feet and a diameter of from one to two feet, besides a species of spruce."

1874 Lieutenant Colonel Ludlow August 3

As he rode south over,

"...a partly level and rolling prairie fairly grassed over...."

he pictures Area 18:

"The Judith Basin,...opened to the north and west, showing a fine, well-grassed, gently-rolling prairie, some fifty miles east and west and sixty miles north and south, of irregular diamond-shape,...

"The basin will some day be a great stock-raising, and, by the aid of irrigation, an agricultural region. It has always been considered a fine hunting country, where game of all kinds could be found, although we saw none, with the exception of a few antelope; the recent presence of the Crow camp having driven it off."

They camped at Judith Gap:

"Camp was made, with good grass and fair water; wood scarce."

Later recommending stationing an outpost of cavalry between the site of Lewistown and Judith Gap, he wrote:

"...the requisites of wood, water, and grass are both excellent and abundant,...."

1880 Granville Stuart, scouting for cattle range:

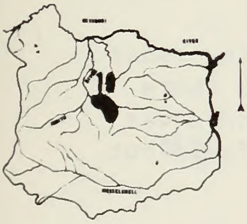
> "We camped for noon on Wolf creek and caught a few small fish. After dinner we packed up and traveled fifteen miles to the forks of Sage creek which runs but little water and looks as though it too went dry in August. Grass fine all over this country, but no wood, not even willows and no shelter for cattle. Saw quite a herd of cattle (Power and Co's) on a small creek before reaching Sage creek."

Stuart wrote of the Judith Basin:

> "...in the center of this grand panorama of mountains and at our feet lies the famous Judith basin. Now with the billowy hills covered with green grass it resembles an enormous lake. It is about sixty miles long and fifty wide. It has magnificent bunch grass but is too open and exposed for a cattle range and the snow too deep. The soil of the basin is very deep and fertile and it would be a splendid farming country if there was a market."

AREA 19 1860 Lieutenant Mullins (Raynolds Expedition)

Going east, crossed to McDonalds Creek on the Musselshell drainage. The march was over a high rolling prairie:



> "July 25. The country over which we passed to-day after leaving the divide, was beautifully diversified in its nature. All the higher hills were covered with dense groves of yellow pine, extending in some instances down the slopes to the rolling country beyond, with now and then, at intervals of two or three miles distance, clear streams of running water. The soil throughout this region is rich, and there is an excellent growth of grass. I think this neighborhood is admirably adapted for agricultural pursuits.
>
> "Game is now becoming more plenty, and to-day we saw signs of buffalo."

1880 Granville Stuart

> "May 19. During this morning's travel we passed through the most beautiful timber thinly scattered along the hillsides and ravines. Mostly straight yellow pines but some fine fir trees also and

plenty of both fit for saw logs. No white pine for poles but many groves of quaking aspens along here. Some yellow pines all along here and finest bunch and other grass all along."

AREA 20 1886 Granville Stuart on McDonald Creek

"Grass nice and green and about four inches high. There are large patches of choke cherries on the creek and quantities of bull berries and red hawthorn bushes.

"Once in awhile there is a very large old cottonwood tree but no young growth of cottonwood at all.

"There is timber on the bluffs on both sides of the creek sufficient for present use....There is good grama and buffalo grass on the bottoms and benches, also some stunted sage among it along here and some greasewood,...."

AREA 21 1880 Granville Stuart

"Water in all these ravines and coulees but is probably not permanent. Good grass in broken good shelter ground until we got on Ford creek side when it became rather short and thin and mixed with stunted sage. Do not like the country north and east of McDonald creek. Too much sage."

AREA 22 1860 Lieutenant Mullins (Raynolds Expedition)

"...Very little vegetation except a few cedar and pine reefs. ...I camped, although there was but a scanty supply of water. There was a little cottonwood, sufficient for fuel, but little grass."

AREA 23 1880 Granville Stuart at Flat Willow Creek:

"...we found the grass better than anywhere since we left the Big Horn but it is not as good even now as we found it on the Little Horn river and its tributaries and it is not so good a looking country for stock down here but comes next to it.

"There are a few plum thickets and choke cherries

> and plenty of box elder, but no ash, and but little cottonwood or under brush. Deep rich soil. "Flat Willow is about thirty to thirty-five feet wide with generally steep cut banks (muddy) but mostly gravel bottom. Water very muddy, like the Rosebud, and from three to four feet deep....Blue joint grass in the bottom but not usually thick enough for hay."

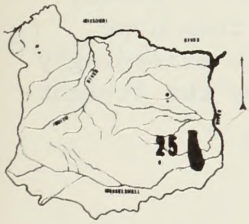
AREA 24 1860 Lieutenant Mullins (Raynolds Expedition)

Travelling south on July 28 wrote of Area 24:

> "...a barren and cheerless country, which was much cut up by hills and ravines; no wood nor water, soil sandy, and containing a large proportion of lime....Fortunately, at 2 p. m., we discovered the valley of the Musselshell river,... a bold, beautiful stream, about 25 or 30 yards wide, with a fine valley, which was diversified by the appearance of groves of cottonwood....
> "The country east and south of it seems very much broken, with constant appearance of pine and cedar reefs. From this point, as far as the eye could reach, the country seemed covered with immense herds of buffalo, all moving toward the valley of the Yellowstone."

AREA 25 1880 Granville Stuart

Travelling north on May 21, Granville Stuart described Area 25:



> "Scant sage and greasewood soon played out and the hills and vales have here a rounded grassy appearance but it is mostly short curly buffalo grass....
> "Feed is very poor since leaving the Yellowstone...."

AREA 26 1880 Granville Stuart

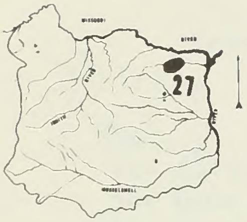
Travelling north:

> "May 11, 1880."
> "...camped at noon on Alkali creek about five miles from the Musselshell river. Water strong of alkali and salty besides, although it runs a small stream with big pools along its course.

> Large bands of antelope and hundreds of buffalo in every direction."

AREA 27 1874 Lieutenant Colonel Ludlow

Travelling southwest from Carroll on the Missouri river:



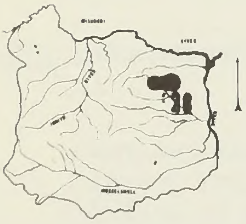
> "The landscape is dreary to the last degree, with rolling and broken outlines. The soil throughout the region is a finely-ground clay of dark ashen hue and texture and irregularly striped by dirty alkaline streaks.
>
> "Wood is almost entirely wanting; water is very scarce, and when found is alkaline and tepid. The vegetation is sage and cactus, with occasionally a little thin, poor grass."

AREA 28 1874 Lieutenant Colonel Ludlow

Nearing the site of Roy, Montana on July 31 reached the boundary of the badlands about seven miles from Box Elder Creek:

> "During the day, two or three single buffalo were seen, and antelope had appeared from time to time since leaving Carroll."

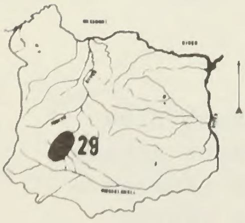
On his return trip September 12, 1874:



> "...no water between Box Elder and Crooked Creek. The bed of the creek was absolutely dry, and the single pool near the road had been trampled into a thick mud....
>
> "...three small but undisturbed pools of water, tepid and alkaline, but much better than none. The grass in the vicinity too, though exceedingly poor and thin, had not been grazed by the freight-trains."

AREA 29 1874 Lieutenant Colonel Ludlow

From Judith Gap south:



> "August 4.
>
> "The gap is formed by a depression five or six miles in width between the timbered Snowy and Belt Ranges. It constitutes the head of the Judith Basin; to the south appearing a broad, level stretch of prairie, sloping down to the Musselshell, twenty or twenty-five miles distant.... Emerging from the gap, the road led west and south

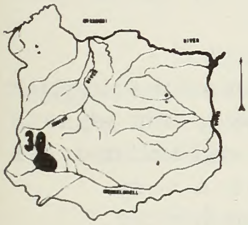
over a dry, sterile, and dusty prairie,...into the valley of the Musselshell, whose freshness and greenness and abundance of timber afforded the strongest contrast to the country behind us."

1880 Granville Stuart June 19

"With the single exception of Cottonwood creek which we crossed two miles before we camped, there is not so much as a willow twig big enough to burn from Reed's ford clear over to Judith gap and on to Hopley hole a distance of sixty miles. There is water in every coulee at this time of the year and little creeks of permanent water every few miles...."

AREA 30 1874 Lieutenant Colonel Ludlow August 4, 5

Camping on the Musselshell:



"The river is twenty-five or thirty feet wide, and on the average seven or eight inches deep, of clear, rapid flow, over a gravelly bottom; the valley level, wide, fertile, and richly grassed, with heavy clumps of timber on the low banks of the stream."

1880 Granville Stuart May 22

"May 22, 1880. Packed up and left camp at 8 A.M. and traveled four miles to Martinsdale at forks of the Musselshell. ...the big spring roundup of cattle is now commencing and there are fifty men camped here who will work down the river fifty or sixty miles,....

"Sunday, May 23, 1880. Had to spend the day here and so stopped at R. H. Glendenning hotel, store, and post office.... No grass here, eaten into the ground. I wonder that the cattle here did not all die last winter... I certainly could not select this for a cattle range but I presume there are five thousand cattle here now."

AREA 31 1874 Lieutenant Colonel Ludlow September 7

Returned to the Musselshell subbasin through Carroll by the Dry Fork of the Musselshell River.

"The route...follows the creek, which flows gently in a wide, fairly-grassed valley, surrounded by

mountains. Many hundreds of cattle were grazing in this valley, which is an excellent stock-range."

AREA 32 1853 Lieutenant Mullan (Stevens Expedition)

"...crossed the Muscle Shell on the morning of the 14th, the stream being fifty yards wide, and from two to five feet deep, with a very rapid current. It winds through a beautiful valley, ten miles wide, covered with excellent grass, and the drift wood showed that the river in high floods reached a width of one hundred and twenty yards.

AREA 33 1874 Lieutenant Thompson (Ludlow's Party)

"Throughout this day's march, an exceedingly large number of antelope were observed, and at our camp on the Porcupine the woods and underbrush were alive with deer showing in a very marked manner the absence of the skin-hunter."

APPENDIX B, Section 2

PHOTOGRAPHIC COMPARISONS FOR TREND

Missouri River Basin and Musselshell River Area

The Missouri River Basin Field Group of the Bureau of Land Management used 168 pairs of repeat photographs for comparative study in the Missouri Basin. The original photos date from 1870 to 1930; between the original and the repeat date, the time span varies from 40 to 100 years.

The user of comparative photos should recognize initially that the original site is sometimes changed by new roads, expansion of towns, or cultivation. Grasses may be difficult to identify because early annual plant growth can obscure perennials, and late grazing often gives a false appearance of overuse. The rate of erosion, establishment of shrubs, and identity of trees can easily be seen; the trend of vegetation may be easy to evaluate for one species and difficult for another because of seasonal variations. Photographs find their best use for providing general conclusions, but they can also be surprising specific.

Comparison of trends in the Musselshell Subbasin with the Missouri River Basin, by photographic pairs reveals certain common trends, the most consistent being a great increase in timber. The low percentage of unfavorable trends in all categories is of interest.

Comparisons show that timber invaded new areas on 64 percent of the Musselshell sites; on 34 percent of the sites there was an increase in size of trees but no invasion of new areas; 2 percent of the sites show a decrease in timbered area. These results are very close to conditions observed generally in the Missouri Basin.

Soil erosion is decreasing on 30 percent of the sites. Soil erosion is stabilized on 59 percent and increasing on 11 percent. These rates compared to the entire Missouri Basin are closely parallel.

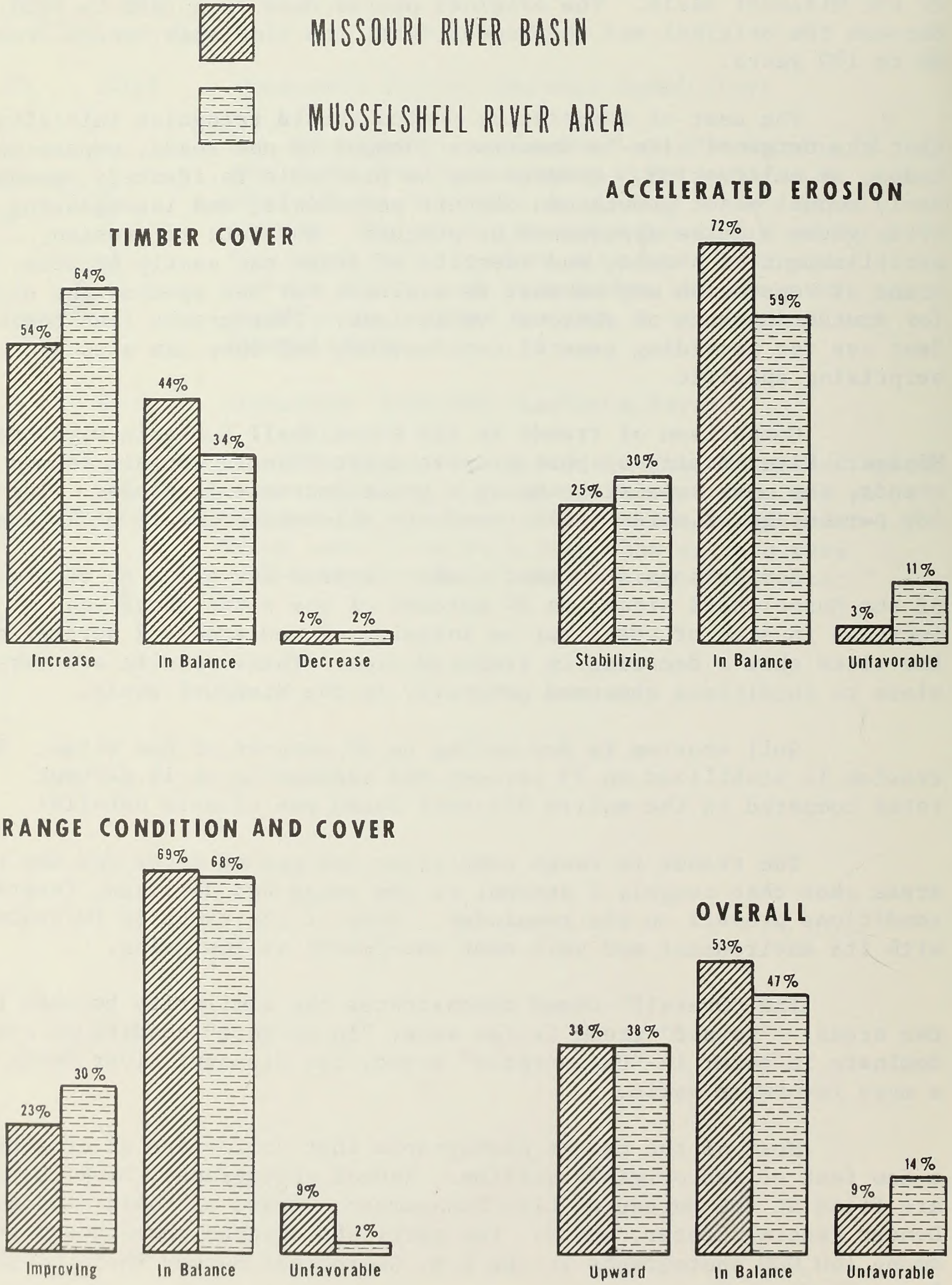
The trends in range conditions and ground cover for the two areas show that roughly 2 percent of the range has declined; favorable conditions prevail on the remainder. Most of the range is in balance with its environment and well over one-fourth is improving.

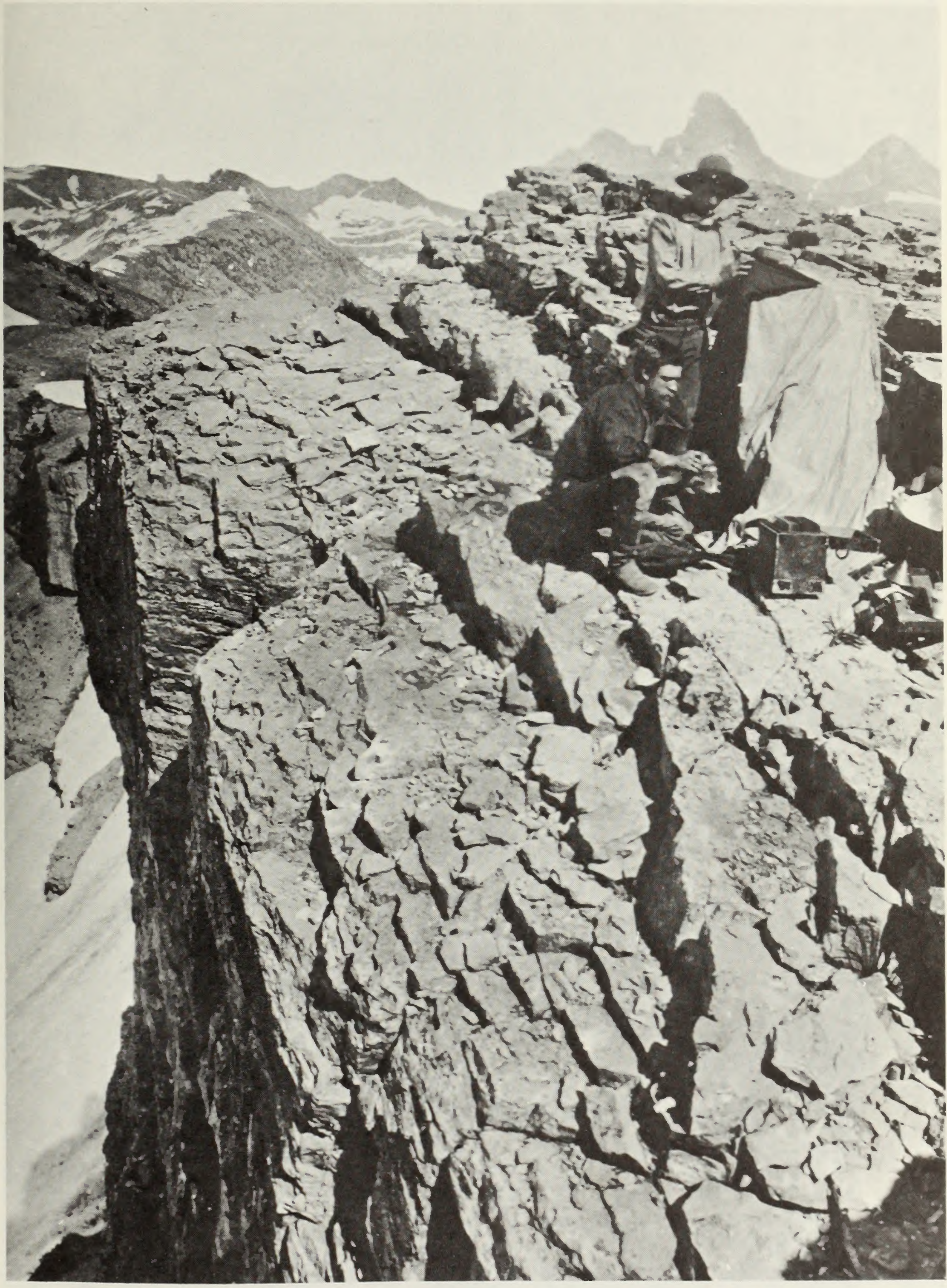
The "Overall" trend demonstrates the similarity between the two areas. "Upward" trend is the same; "In Balance" conditions predominate in both; in "Unfavorable" trend, the Missouri River Basin has a more favorable ratio.

Most of the repeat photographs that follow are at or within a few feet of the original station. Repeat photographs, by R. D. Burr, are filed at the Bureau of Land Management, Office of Basin Studies, Denver Federal Center, 80225. The early photographs were chosen from among 140,000 photographs in the U.S. Geological Survey Photo Library, Denver Federal Center.

COMPARISON OF TRENDS

for
MISSOURI RIVER BASIN
and
MUSSELSHELL RIVER AREA





To record the old west, photographers combined the talent of an artist with the science of a chemist and the constitution of a pack horse. W. H. Jackson photograph, 1872. U. S. Geological Survey.

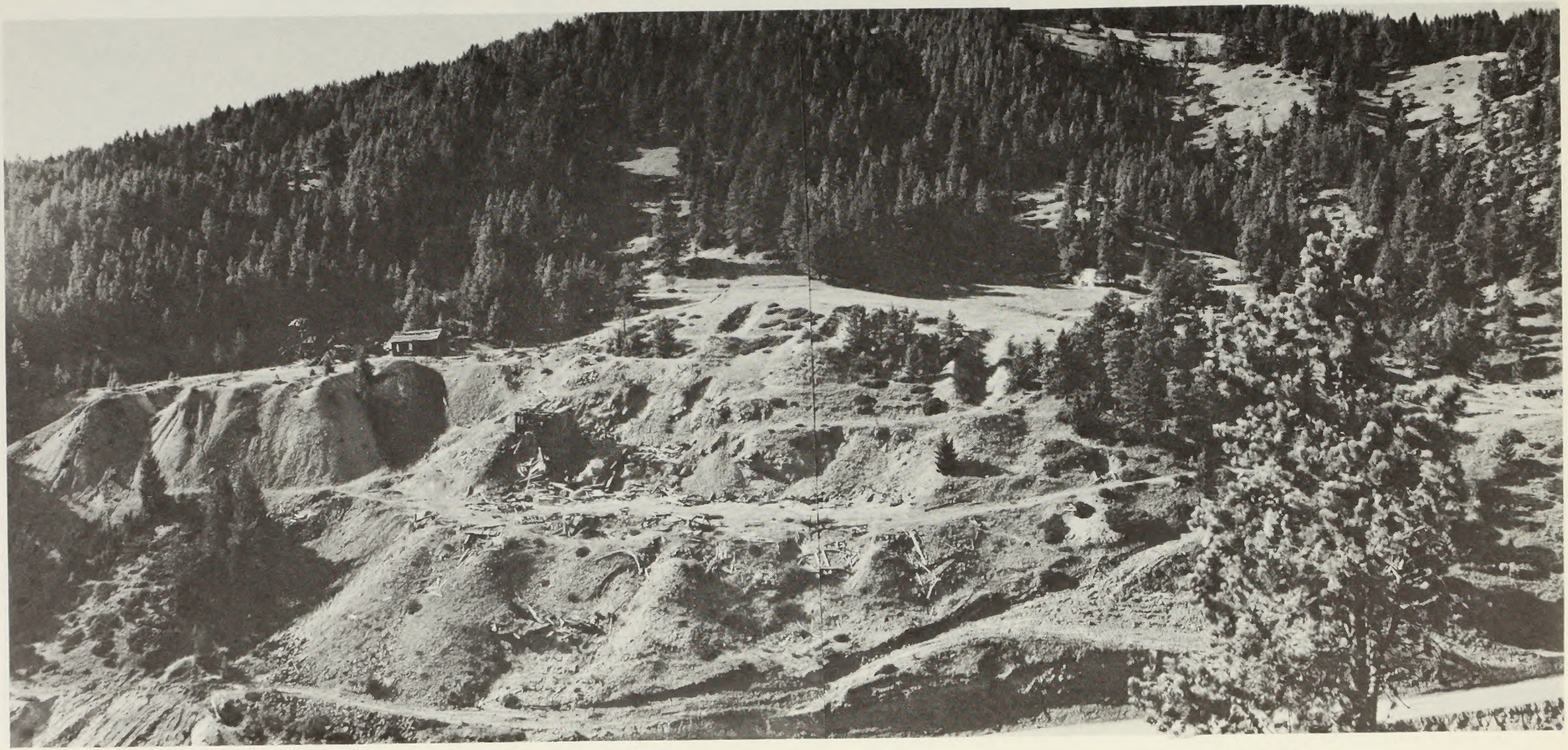


Figure 38 Top photo Weed, USGS 1892. Bottom photo Burr, BLM 1964. Time span 72 years. Photographic comparison pair at location of Spotted Horse Mine, a large gold producer in Maiden Canyon, Fergus County. Illustrating recovery of timber and associated vegetation on slopes denuded during operation of Spotted Horse Mine. The re-establishment of ground cover and root systems has greatly improved the resistance of hillside soils to removal by erosion.

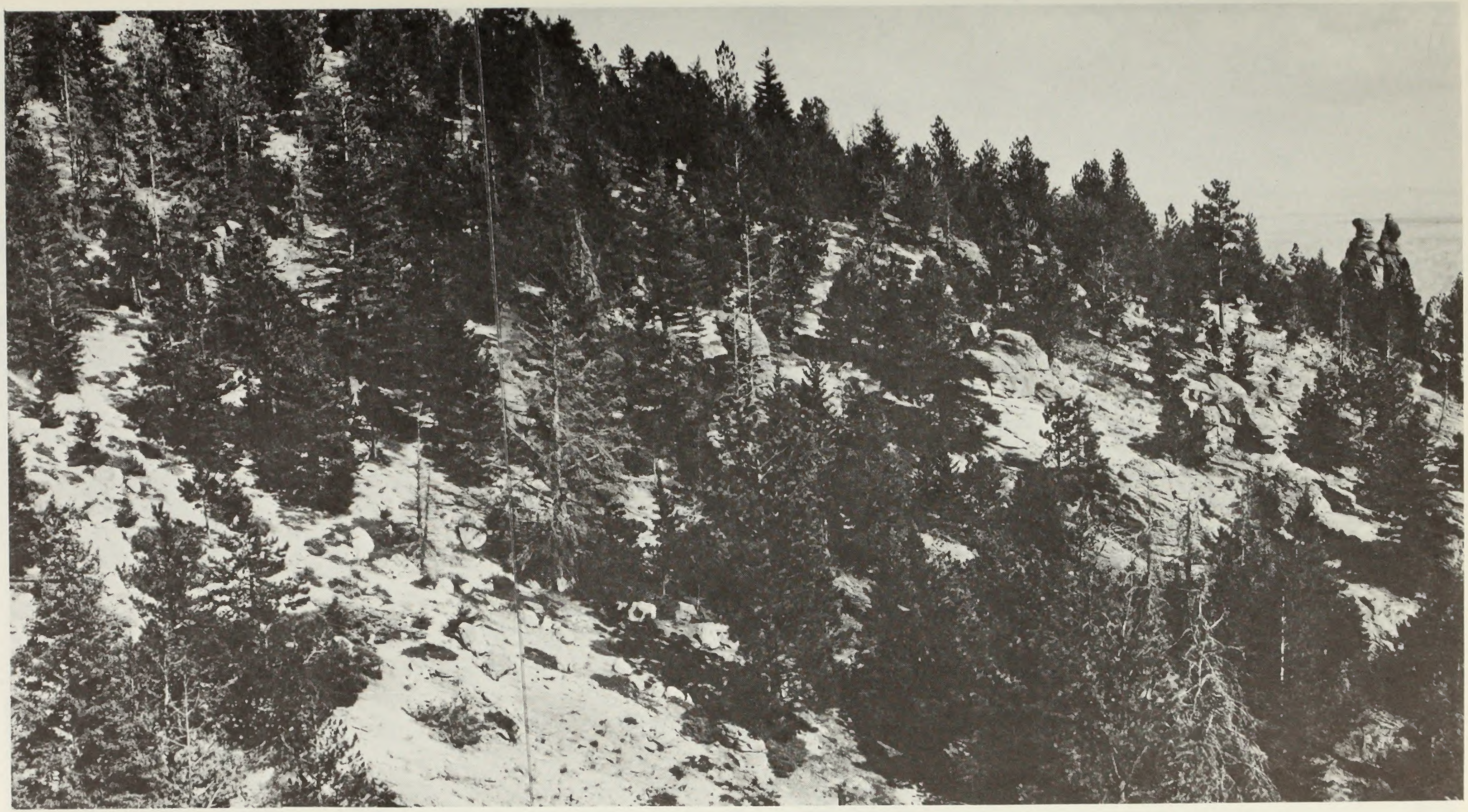


Figure 39 Top photo W. Cross, USGS 1904. Bottom photo Burr, BLM 1965. Time span 61 years. Timber cover has been established on the slopes of Square Butte, Chouteau County, by the spread of trees from nearby stands. Square Butte is unique in being grazed only by wildlife, due to vertical rock formations at the base which effectively exclude livestock. The invasion by timber species of previously non-forested locations is a widespread phenomenon observed not only in Montana, but in Wyoming, Alaska, the Dakotas, Wisconsin and Michigan.

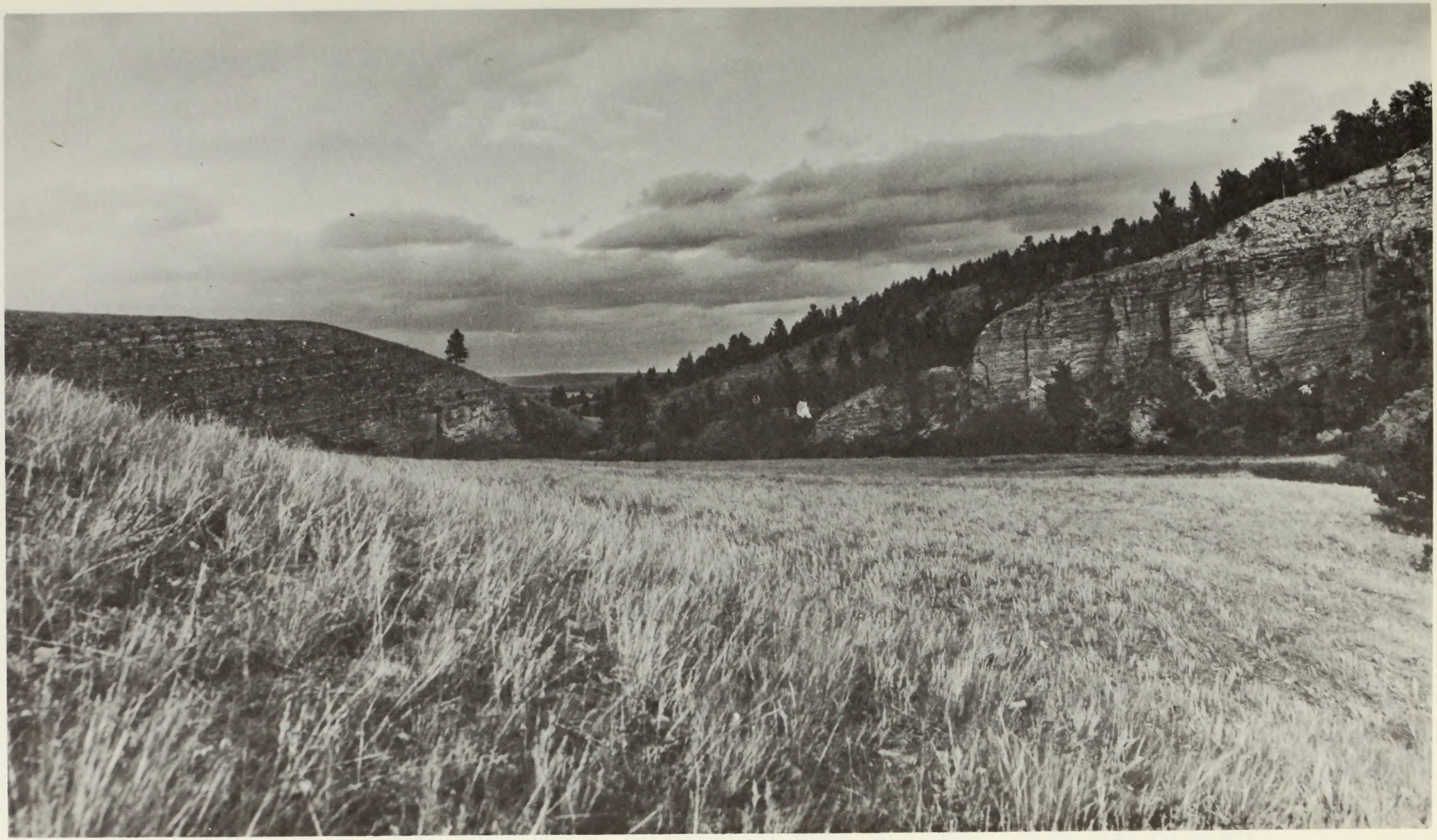


Figure 40 Top photo T.W. Stanton, USGS 1903. Bottom photo Burr, BLM 1964. Time span 61 years. Early photograph taken along Elk Creek, Petroleum County, shows rangeland in unsatisfactory condition and forage yield low. In the modern photo, vigorous native grasses protect the soil, and provide much improved forage yield.

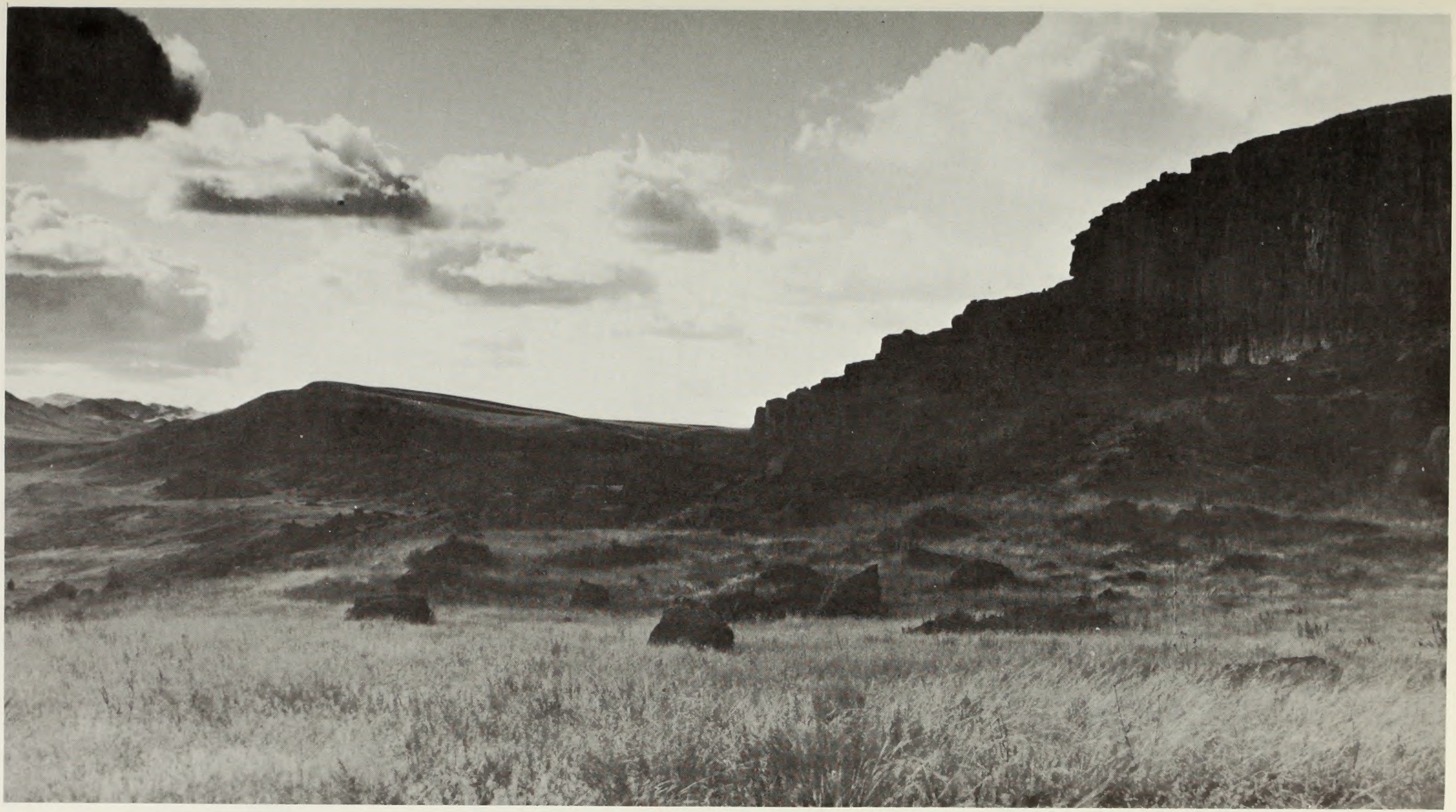


Figure 41 Top photo W. Cross, USGS 1904. Bottom photo Burr, BLM 1964. Time span 60 years. A long-abandoned bed of the Missouri River has benefitted from excellent recovery of native grasses, following the overutilized condition of 1904. Fringed sagebrush, a low grade forage species is abundant in the early photograph. Needlegrass is the principal forage plant in the recent picture; downy brome, a less desirable annual grass is still present in quantity, illustrating the need for additional improvement. Location is in Chouteau County.

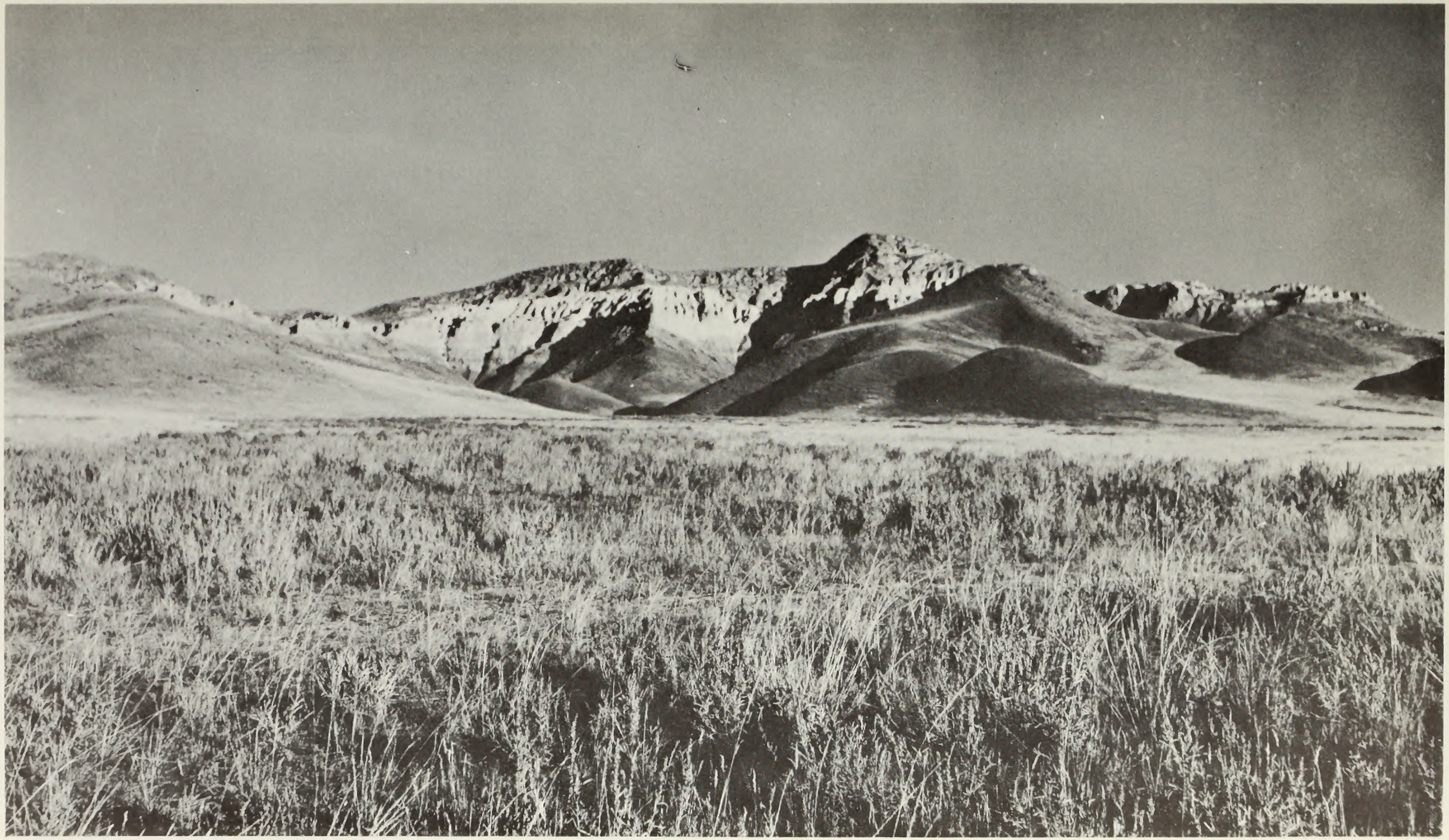


Figure 42 Top photo W.G. Pierce, USGS 1932. Bottom photo Burr, BLM 1964. Time span 32 years. Rangeland cover in foreground is relatively stable, and its condition changed little over the 32 years which elapsed between photos. The proportions of silver sagebrush and grass are similar in both views. Drainage channels on lower slopes of stabilized dunes in middle distance are marked in recent picture by lines of brush which may have been grazed down to ground level during the drought year of 1932.

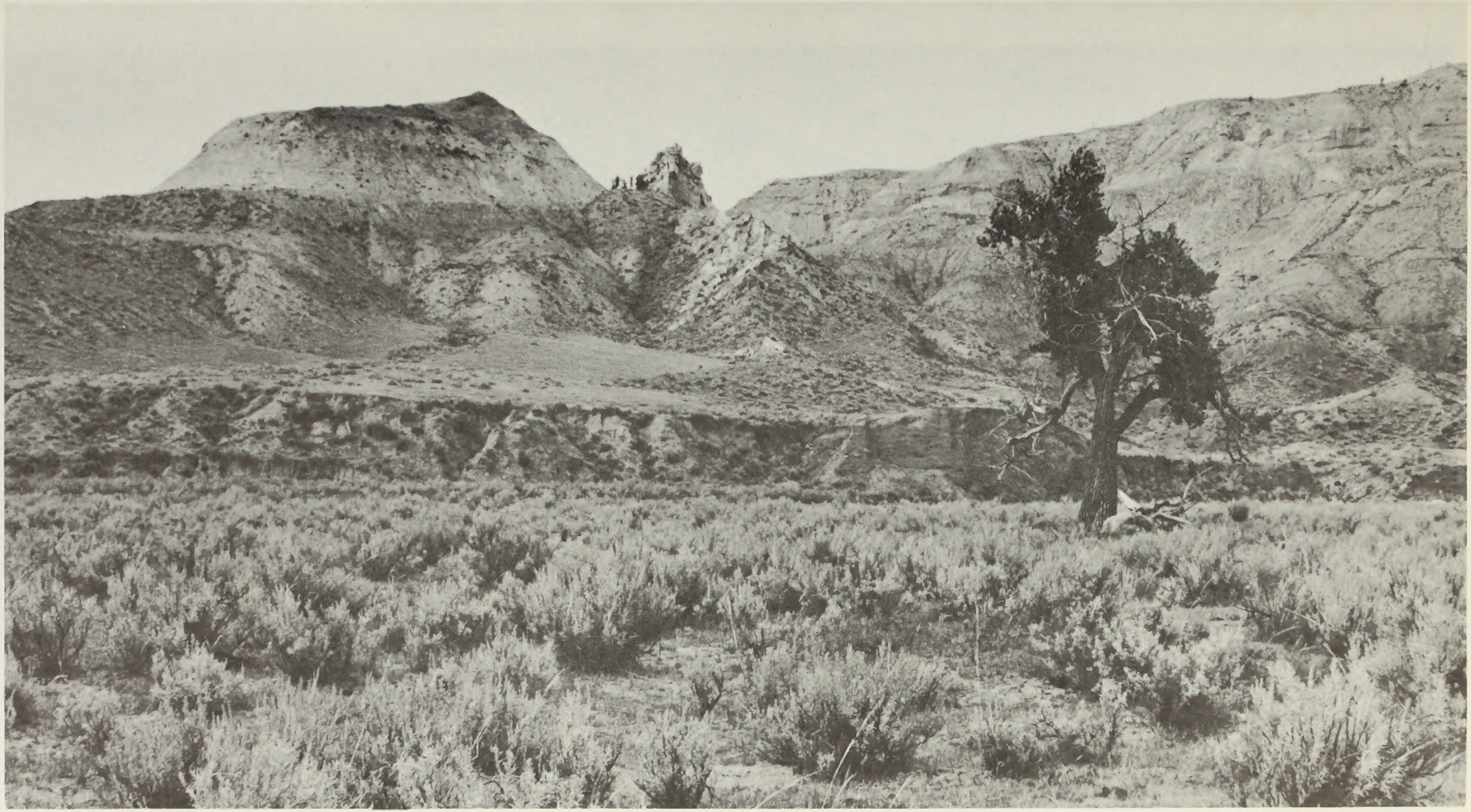


Figure 43   Top photo T.W. Stanton, USGS 1905. Bottom photo Burr, BLM 1964. Time span 59 years. Silver sagebrush on level bottomlands along Dog Creek, Fergus County, has increased since time of early photograph. The same is true of big sagebrush on raw creek bank soils, and slopes in middle distance. The susceptibility to erosion has been effectively reduced by this vegetative uptrend. Foreground vegetation in recent photo is vigorous, but the persistent bare spots show there is room for improvement. Same tree is seen in foreground of both pictures.

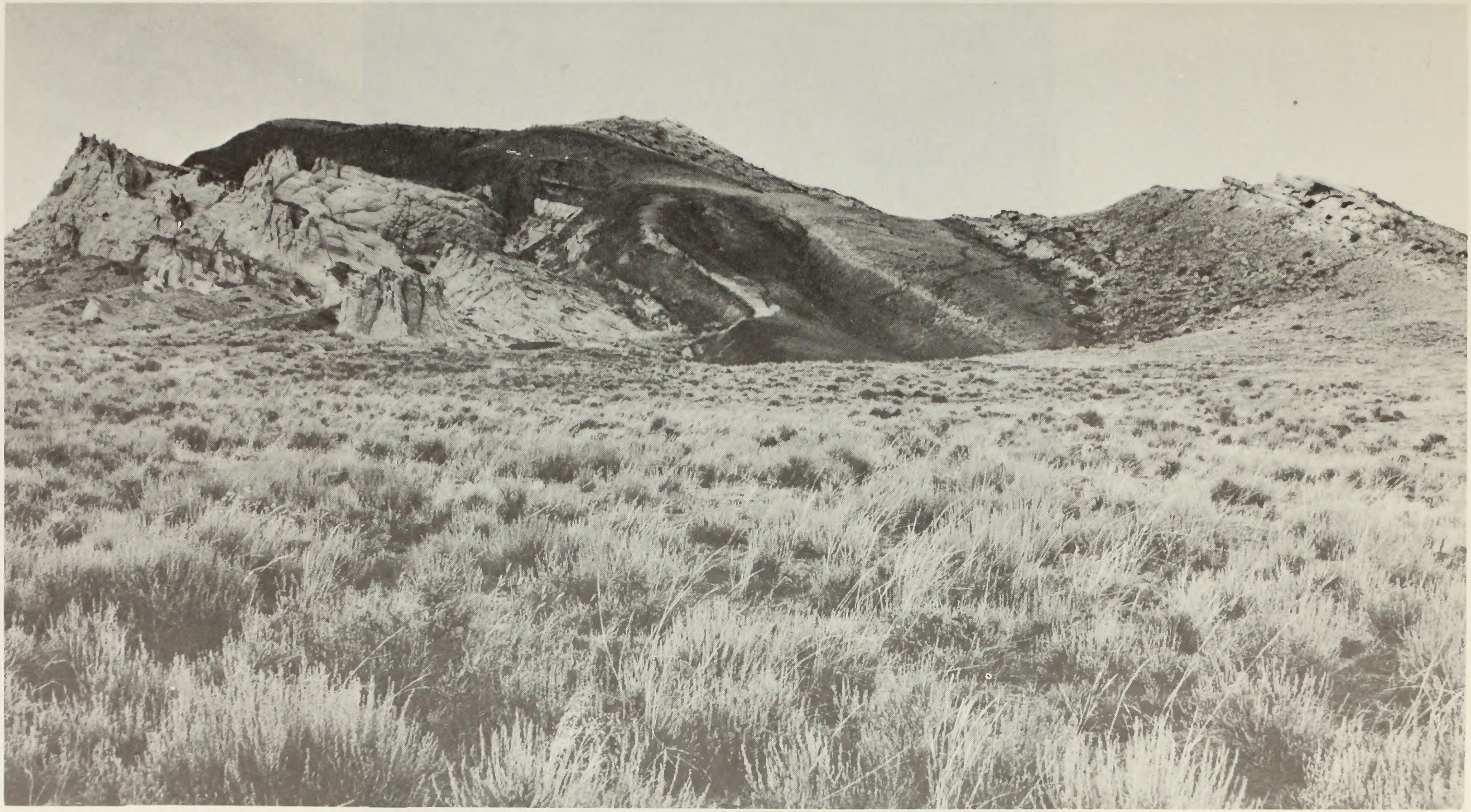
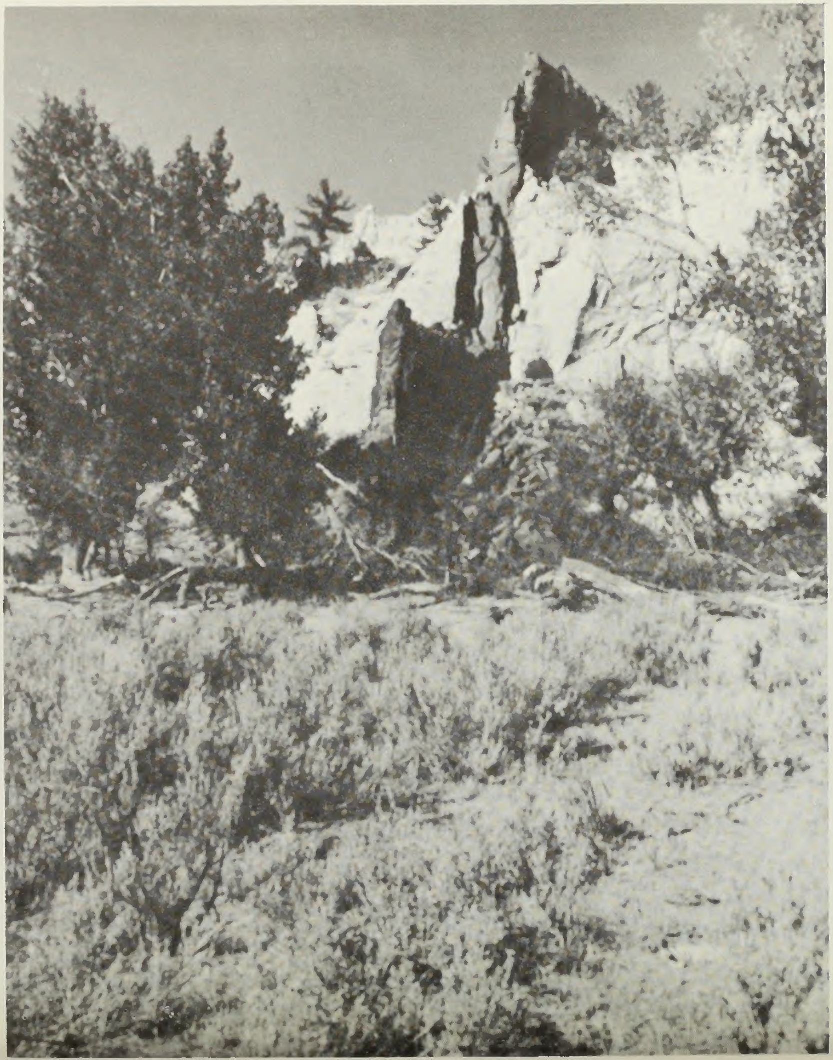


Figure 44 Top photo T.W. Stanton, USGS 1905. Bottom photo Burr, BLM 1964. Time span 59 years. Invasion of perennial grassland by sagebrush has been completed on broad valley bottom near mouth of the Judith River. This site occupies a natural north-to-south route of travel, and has undoubtedly seen very heavy use by migrating and grazing animals for centuries. Lewis and Clark noted Indian encampments here in 1805. The remaining grass is still heavily used, and vegetative trend continues down.



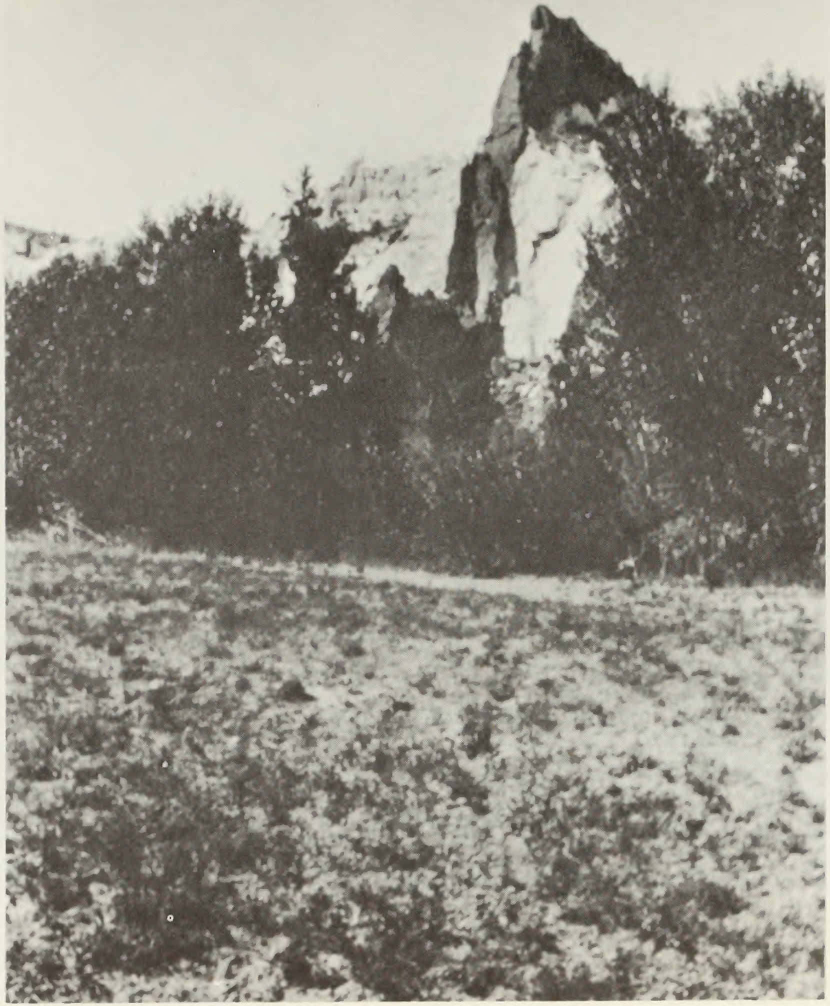


Figure 45 Top photo L.J. Pepperburg, USGS 1910. Bottom photo Burr, BLM 1966. Time span 56 years. Vegetation has improved greatly on streambottom near foot of basalt dike during 56 year interval between pictures. Perennial grasses and big sagebrush have greatly increased the carrying capacity, and erosion resistance of the land. Site is in Chouteau County.

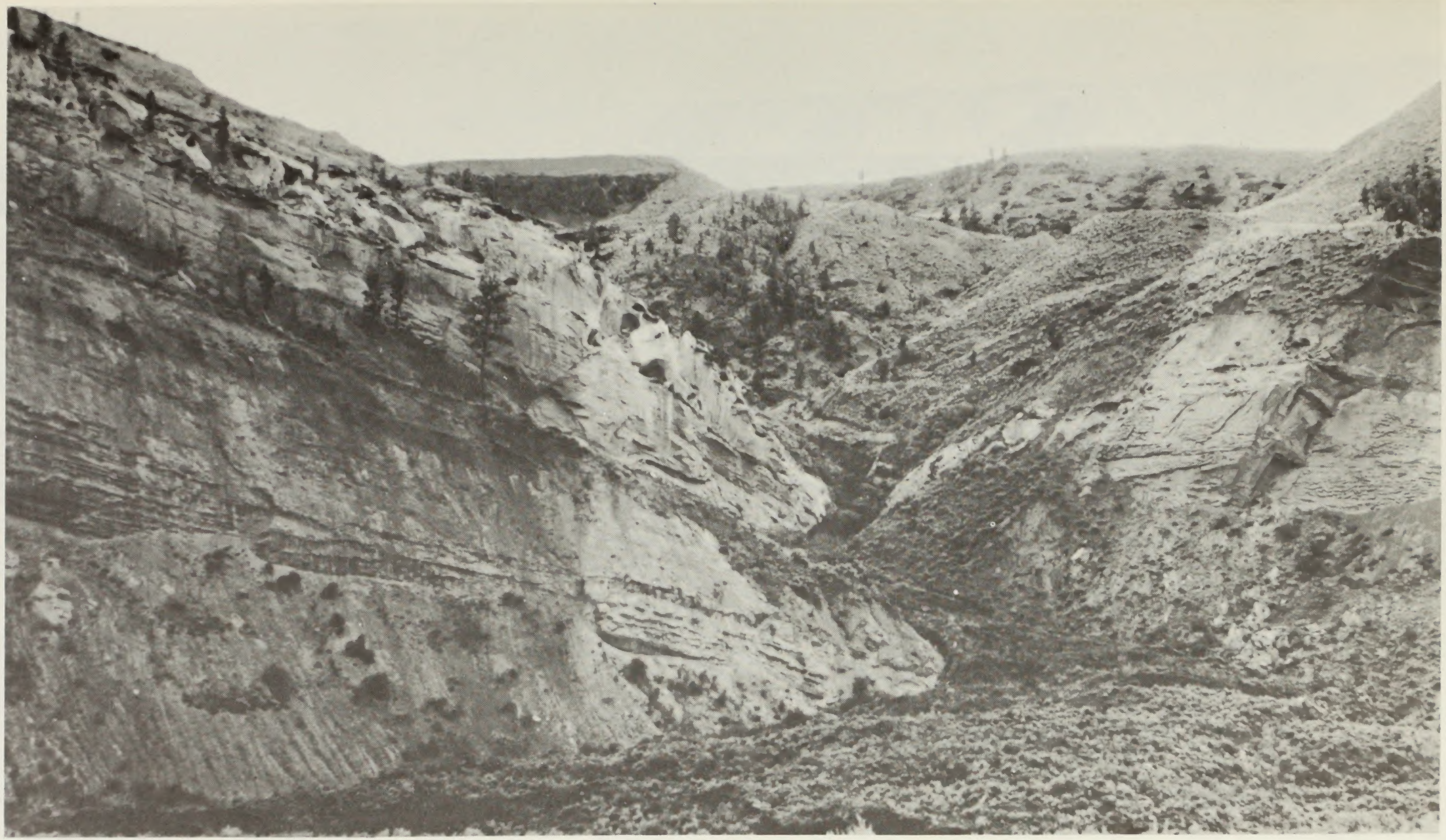


Figure 46 Top photo T.W. Stanton, USGS 1905. Bottom photo Burr, BLM 1964. Time span 59 years. The leading edge of a mud flow emerging from a tributary canyon into Dog Creek was washed away by the stream sometime before the early photo was taken. The resulting raw soil seen in the exposed cut has since been taken over by sagebrush and weeds, greatly improving its resistance to erosion. The body of the mud flow, extending back up its canyon, has also been revegetated by nature, aiding in soil stabilization. The scene is in Fergus County.

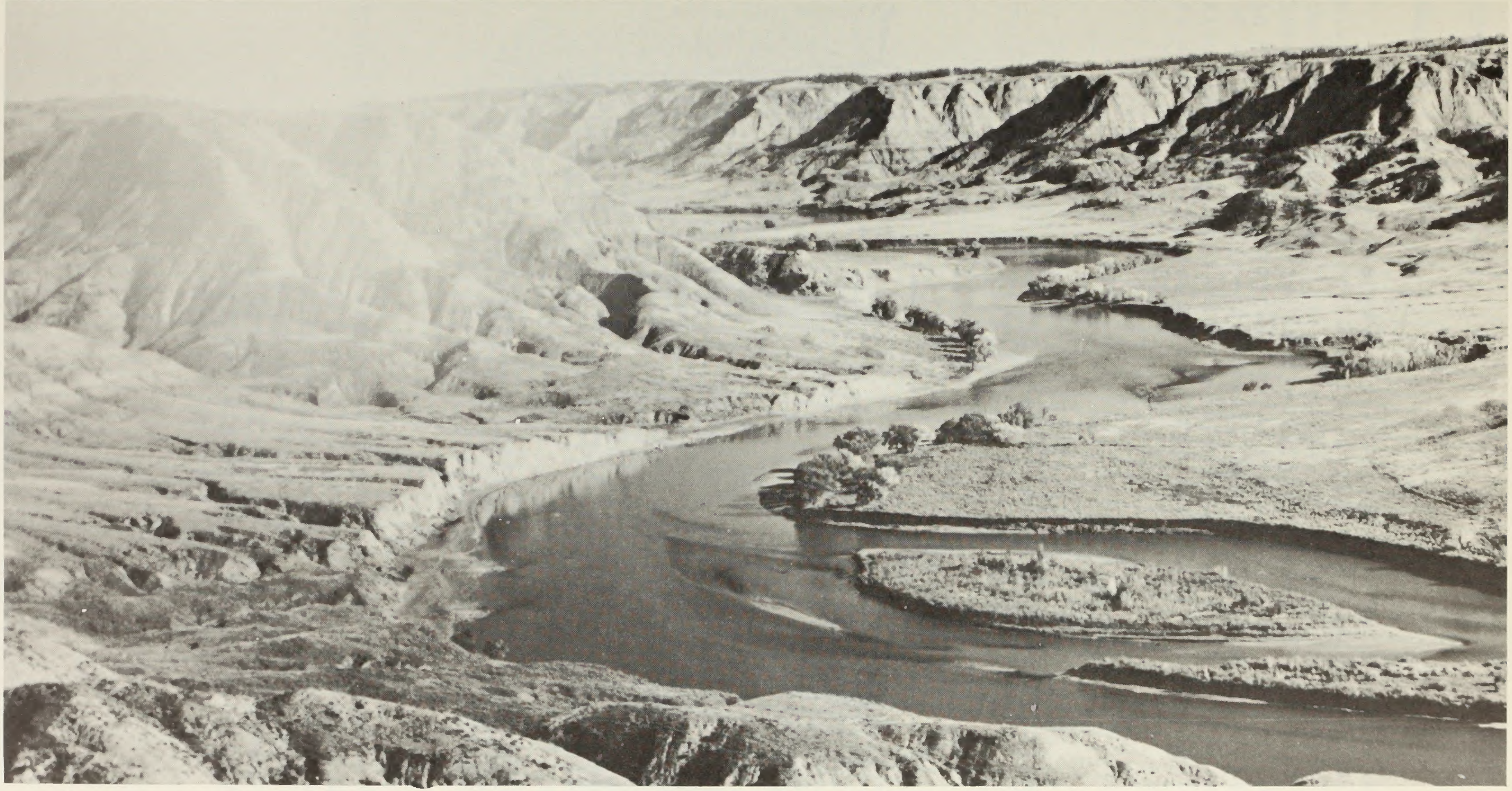


Figure 47 Top photo T.W. Stanton, USGS 1903. Bottom photo Burr, BLM 1964. Time span 61 years. Iron City Islands, in Missouri River, Fergus County; observer is looking downstream. According to Lewis and Clark journals there were no islands here in 1805. By 1890 two islands had appeared, the downstream tip of the second island being barely visible in right margin of older photo. In the modern photo, both of the older islands have disappeared, being replaced by new ones. One of the recent islands appears to be a remnant of the streambank, cut off from the mainland by an avulsive river change. Gulley erosion along left bank river terrace in middle distance has increased.

EROSION - PIPING

A form of erosion often overlooked but inherent to the entire Missouri River Basin is that of "piping". Piping is worldwide in occurrence especially in dry lands. It takes a destructive form with steep-sided gullies and lays waste large areas of soil. Burr, (1942), in a preliminary investigation on piping found as much as 20 percent of the area of livestock ranches, immediately adjacent to the Canadian River in Texas, were eroded solely by piping. The loss in productivity is drastic; many piped areas become barren, picturesque waste.

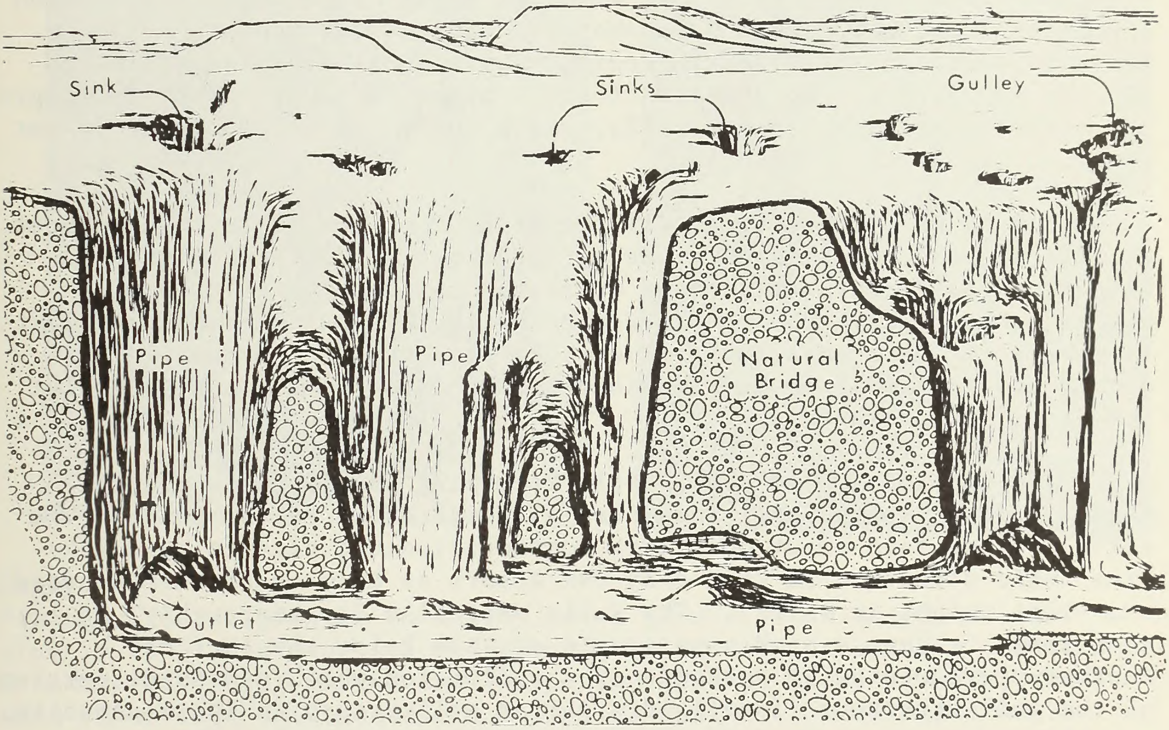


Figure 48 A diagram of piping, a form of erosion found in the Missouri River Basin. Vertical pipes or "sinks" outlet through horizontal pipes developed on an impermeable layer, into a gully, itself formerly a horizontal pipe. The gully developed by collapse of natural bridges. Topography of this nature is termed a "pseudokarst".

The worst problem is the difficulty of control. Other forms of erosion are normally controlled by vegetation or by surface structures designed to slow the transportation of soil particles. Water erosion is combated by terraces, water spreading and check dams; wind erosion is controlled by plant barriers and occasionally artificial barriers. With piping, which depends solely on water, a structure such as a terrace or dam will only aggravate the problem and have disastrous results.

Parker and Jenne[1/] state: "...Piping is the development of subsurface drainage systems in earth materials, to a depth no greater than the nearby base level of drainage. It results in a surface expression much like miniature solution depressions in limestone or dolomite terrains..." This resemblance is in appearance only. Solution plays no important part in development of piping. The erosion forms resulting are termed pseudokarst. (True karst topography is found in limestone or dolomite regions where, unlike piping, solution of rock in water is the creative force. Sinks, caverns, natural bridges, subterranean streams, sheer cliffs, and a general lack of surface water characterize karst terrain.)

As has been stated, all the Missouri River subbasins, without exception, have the prerequisites for piping, "...Sufficient water either to cause drainage through cracks or to saturate a layer of higher permeability than the layers below it, hydraulic head sufficient to move water through a subsurface rock, presence of a permeable (or deeply cracked) soil or bedrock above gully floor level, and an outlet for flow..." 2/ Figure

The soils most susceptible to piping are found in all the Missouri River subbasins. These are alluvial often saline soils. The soils must contain about one-fifth montmorillonitic clay (a sandwich-like ionic structure in this clay can absorb as much as sixteen hundred times its weight in water). The soils must also dry thoroughly, at some time, or have a highly permeable stratum below the surface. Another prerequisite is presence of a sodium ion which causes dispersion of the soil structure (locally dry buried soils, such as loess deposits, may also pipe when wetted in some unusual circumstance). Silts and clays are the two main soils most susceptible to piping. Conditions favoring piping are so widespread that it is a serious problem in management of range lands and especially in the establishment of artificial structures such as dams or roads.

1/ Structural Failure of Western U. S. Highways Caused by Piping, U. S. Geological Survey, January 18, 1967, Parker,G.G., and Jenne,E.A.

2/ Ibid.

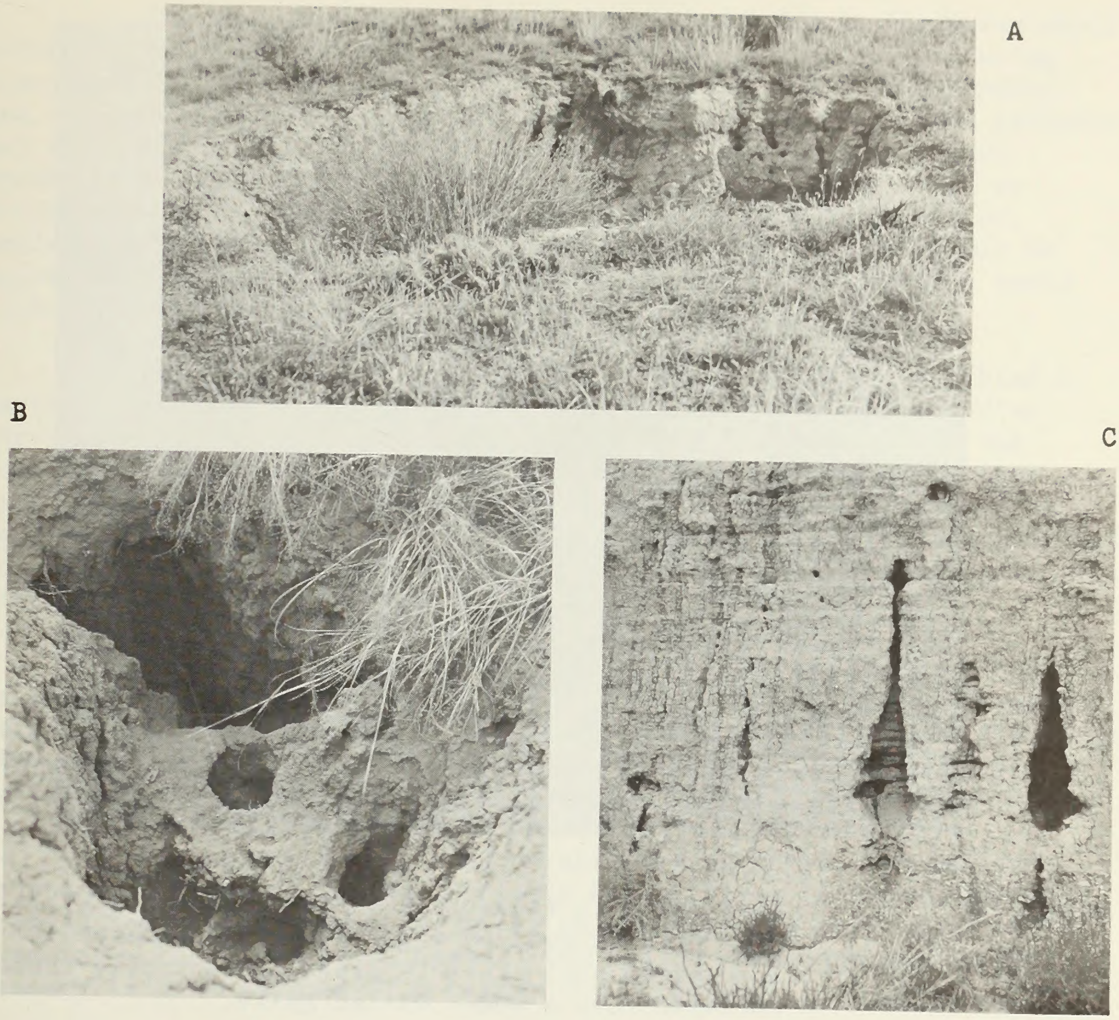


Figure 49
Piping often originates on fairly level ground. The large vertical pipe in "A" could have started when water runoff percolating downward encountered a long buried and dessicated lens of loess or silt, that upon saturation collapsed into a smaller space. The collapse would have been followed by a subsidence of the surface. Looking downward into a large pipe "B" shows a subsidence in which vertical pipes developed later.

Dry soils susceptible to piping usually develop wide deep cracks that extend downward several feet. Piping can start in these cracks even on steeply sloping soils. Surface runoff pouring down the crack enlarges it by cutting until a layer is reached where horizontal pipes must develop, then the water usually outlets into an arroyo or gully, such as that in "C", where the stream has now cut away its channel wall to reveal cross sections of vertical pipes.

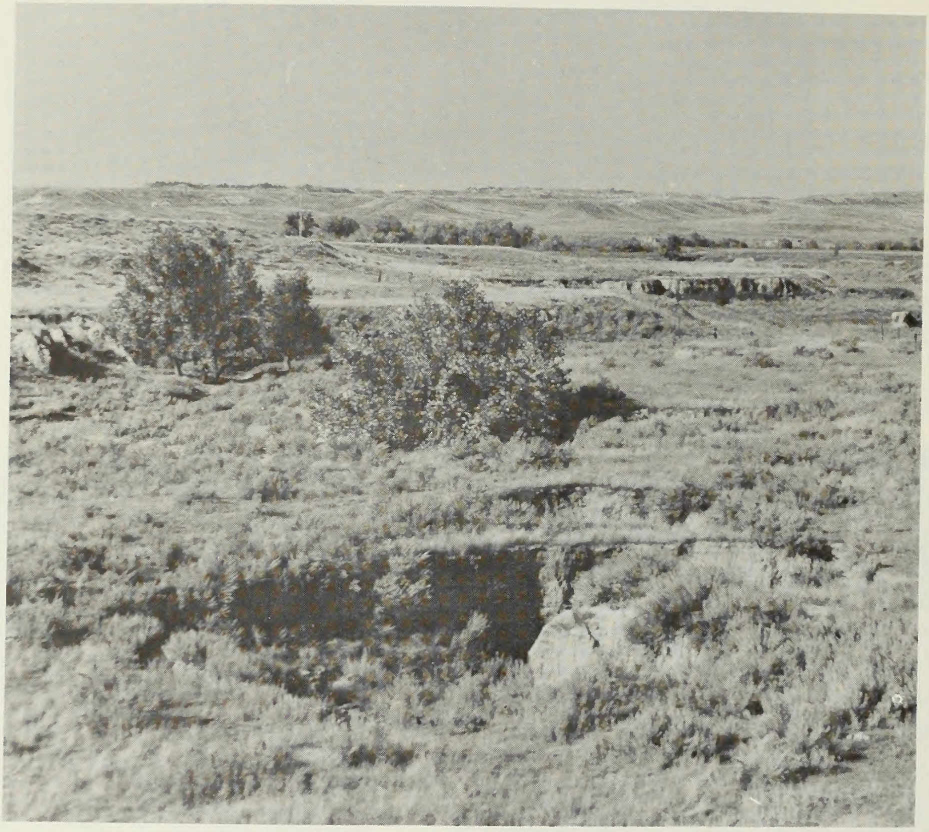


Figure 50 This gully is actually a collapsed horizontal pipe bridged over by a series of broad natural bridges of soil still in place. Eventually these collapse into a sheer walled gully.

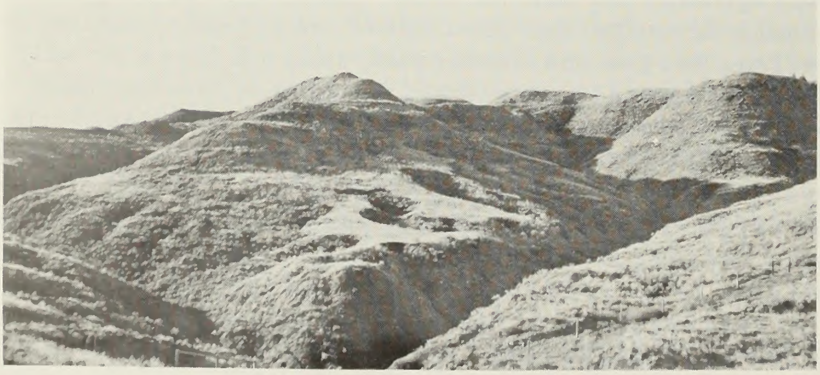


Figure 51 Sinks join together in gullies in mid-distance. These sinks were formed by collapse and subsidence of subsurface pipes which riddle the soil.

The most common type of piping encountered in the Musselshell subbasin is where cracks are formed by a soil drying and shrinking. Runoff enters this crack at the soil surface and moves down eroding the walls. If the hydrologic gradient is steep a fine-grained sediment may be transported in suspension along this vertical crack, then through a horizontal crack into an outlet on the side slope of an arroyo or gully. Cracks are the usual starting point for a pipe; sediment deposits, however, such as loess below the surface, may be moistened to saturation and slump to start infiltration into a small sink. The start is like that in Figure 49.

Construction such as a dam or wall confines water behind a barrier, creating hydraulic heads that can start a subsurface flow carrying water-saturated earth materials. This discharges on the down side of the barrier. The Bureau of Land Management and other land management groups encounter this entrainment type of piping in construction of stock or erosion control dams on soils or base material susceptible to piping. Once piping starts the overlying structure will often collapse.

A third type of piping is similar to the entrainment type. In this a hydraulic head transports clay and silt and sand through a stratum with sufficient velocity to maintain its identity and discharge them into a gully. These gullies are formed and enlarged through collapse and coalescence of the piped structures, Figures 50 and 51.

Piping can form extensive networks of caves. In badlands on the headwaters of the North Platte River, pipes in a clay derived from saline shales extend for miles in tubes from 8 to 12 feet in diameter. These ramify throughout the entire area, and spectacular scenery is often formed by collapse of the tubes.

APPENDIX B, Section 4

PLANT FREQUENCIES

The following table shows the number of times each species occurred in 644 observations. It also shows the number of times in 644 in which each species made up 15 percent or more of the total vegetation. (See The Public Lands, Range Vegetation Section.)

COMMON NAME	TOTAL OCCURRENCES IN 644 OBSERVATIONS	OCCURRENCES WHERE SPECIES PRODUCED OVER 15% OF THE VEGETATION
WESTERN WHEATGRASS	510	314
BLUE GRAMA	391	162
PRAIRIE JUNEGRASS	356	41
BLUEBUNCH WHEATGRASS	348	230
NEEDLEANDTHREAD	340	129
GREEN NEEDLEGRASS	328	36
FRINGED SAGEBRUSH	327	9
BIG SAGEBRUSH	272	93
SANDBERG BLUEGRASS	248	48
THREADLEAF SEDGE	243	48
PONDEROSA PINE	234	55
ROSE SPECIES	213	3
SEDGE SPECIES	211	33
PRAIRIE SANDREED	188	11
IDAHO FESCUE	168	61
BROOM SNAKEWEED	155	1
PRICKLY PEAR	138	3
JUNIPER SPECIES	136	2
WESTERN YARROW	130	
SILVER SAGEBRUSH	118	8
STONEYHILLS MUHLY	116	2
PHLOX SPECIES	108	
DOUGLAS-FIR	106	26

COMMON NAME	TOTAL OCCURRENCES IN 644 OBSERVATIONS	OCCURRENCES WHERE SPECIES PRODUCED OVER 15% OF THE VEGETATION
LITTLE BLUESTEM	105	1
PLAINS REEDGRASS	96	8
LUPINE SPECIES	95	
INDIAN RICEGRASS	86	
HOODS PHLOX	78	
CACTUS SPECIES	76	
CURRANT SPECIES	75	
CHEATGRASS BROME	71	4
LOCO;MILKVETCH SPECIES	65	
ERIOGONUM SPECIES	65	
YUCCA SPECIES	65	
KENTUCKY BLUEGRASS	63	15
SAGEBRUSH SPECIES	60	
JAPANESE BROME	60	
SNOWBERRY SPECIES	57	4
RABBITBRUSH SPECIES	55	
SKUNKBRUSH SUMAC	54	
OYSTER PLANT	51	
CURLYCUP GUMWEED	50	
ASTER SPECIES	50	
WHEATGRASS SPECIES	50	29
INLAND SALTGRASS	49	6
RED THREEAWN	48	
GOLDENWEED SPECIES	48	
LIMBER PINE	47	6
BLACK GREASEWOOD	47	6
BLUEGRASS SPECIES	47	10
RUBBER RABBITBRUSH	46	1
CRAZYWEED SPECIES	43	

COMMON NAME	TOTAL OCCURRENCES IN 644 OBSERVATIONS	OCCURRENCES WHERE SPECIES PRODUCED OVER 15% OF THE VEGETATION
FLEABANE SPECIES	43	
WESTERN SNOWBERRY	43	1
AMERICAN VETCH	42	
WOOLY INDIANWHEAT	40	
COMMON WINTERFAT	40	
SMALL SOAPWEED	39	
COTTONWOOD SPECIES	39	
COMMON SUNFLOWER	38	
ELK SEDGE	36	4
TIMOTHY	35	5
COMMON DANDELION	35	
MOUNTAIN GOLDENPEA	35	
MINT SPECIES	34	
SCURFPEA SPECIES	30	
SCARLET GLOBEMALLOW	29	
ONION SPECIES	28	
FREMONT POPLAR	28	6
QUAKING ASPEN	28	4
PUSSYTOES SPECIES	27	
FOXTAIL BARLEY	26	5
DOTTED GAYFEATHER	26	
DEATHCAMAS SPECIES	25	
SUMAC SPECIES	25	
LODGEPOLE PINE	24	8
ROUGH FESCUE	23	6
MUTTON BLUEGRASS	22	5
CREEPING JUNIPER	22	
WILLOW SPECIES	21	2
BISCUITROOT SPECIES	20	
COMMON RUSSIANTHISTLE	19	

COMMON NAME	TOTAL OCCURRENCES IN 644 OBSERVATIONS	OCCURRENCES WHERE SPECIES PRODUCED OVER 15% OF THE VEGETATION
NEEDLEGRASS SPECIES	18	9
HAWTHORN SPECIES	18	
MENZIES LARKSPUR	17	
POVERTY SUMPWEED	17	
TOADFLAX	16	
SALTBUSH SPECIES	16	
SIERRA JUNIPER	16	1
COMMON CHOKEBERRY	16	
FESCUE SPECIES	15	2
SIXWEEKS FESCUE	15	2
CANBY BLUEGRASS	14	4
LARKSPUR SPECIES	15	
SLIMFLOWER SCURFPEA	15	
GARDNER SALTBUSH	15	
CANADA THISTLE	15	
CRESTED WHEATGRASS	14	1
MOUNTAIN BROME	14	
AMERICAN LICORICE	14	
BUFFALO-BERRY SPECIES	14	3
BARBERRY SPECIES	14	
LITTLE LARKSPUR	13	
FOURWING SALTBUSH	13	
GUMWEED SPECIES	12	
MONOLEPSIS SPECIES	12	
MULESEARS WYETHIA	12	
MOUNTAIN DEATHCAMAS	11	
SIDE-OATS GRAMA	10	
DANTHONIA SPECIES	10	2
VEGETABLE OYSTER	10	
GOLDENROD SPECIES	10	
BROME SPECIES	9	
WILDRYE SPECIES	9	
NORTHERN BEDSTRAW	9	
SLENDER WHITE PRAIRIECLOVER	9	
THICKSPIKE WHEATGRASS	8	
YELLOW SWEETCLOVER	8	

COMMON NAME	TOTAL OCCURRENCES IN 644 OBSERVATIONS	OCCURRENCES WHERE SPECIES PRODUCED OVER 15% OF THE VEGETATION
PENSTEMON SPECIES	8	
SAXIFRAGE SPECIES	8	
SASKATOON SERVICEBERRY	8	
CHOKECHERRY SPECIES	8	
NEEDLEANDTHREAD and GREEN NEEDLEGRASS MIXTURE	7	5
ALKALI SACATON	7	1
THISTLE SPECIES	7	
GERANIUM SPECIES	7	
INDIANWHEAT SPECIES	7	
PANICUM SPECIES	7	
CANADA WILDRYE	6	
SAND DROPSEED	6	
PRAIRIE CORDGRASS	6	1
SANDWORT SPECIES	6	
STRAWBERRY SPECIES	6	
DOCK SPECIES	6	
VETCH SPECIES	6	
DOUGLAS RABBITBRUSH	6	
INTERMEDIATE WHEATGRASS	5	
TIMBER DANTHONIA	5	1
BASIN WILDRYE	5	
MUSTARD SPECIES	5	
LAMBSQUARTERS GOOSEFOOT	5	
SHEEP SORREL	5	
GROUNDSEL SPECIES	5	
CLOVER SPECIES	5	
GRAMA SPECIES	5	
RUSH SPECIES	4	1
RUBBERWEED SPECIES	4	
SHOOTINGSTAR SPECIES	4	
SWEETCLOVER SPECIES	4	
LAMBERT CRAZYWEED	4	
RUE SPECIES	4	

COMMON NAME	TOTAL OCCURRENCES IN 644 OBSERVATIONS	OCCURRENCES WHERE SPECIES PRODUCED OVER 15% OF THE VEGETATION
VEINY MEADOWRUE	4	
FLANNEL MULLEIN	4	
COCKLEBUR SPECIES	4	
BLACK SAGEBRUSH	4	
ALDER SPECIES	4	
NODDING BROME	3	
PINEGRASS REEDGRASS	3	
BOTTLEBRUSH SQUIRRELTAIL	3	
PASQUEFLOWER SPECIES	3	
PAINTED CUP SPECIES	3	
SILKY CRAZYWEED	3	
KNOTWEED SPECIES	3	
PURPLE PRAIRIECLOVER	3	
VIOLET SPECIES	3	
CREEPING BARBERRY	3	
NINEBARK SPECIES	3	
DOUGLAS HACKBERRY	3	
MOUNTAIN MUHLY	2	
SHOWY ONIONGRASS	2	1
ARNICA SPECIES	2	1
AGOSERIS SPECIES	2	
SPIDERFLOWER SPECIES	2	
NUTTALL MONOLEPSIS	2	
BLUEBELL SPECIES	2	
SAND SAGEBRUSH	2	
BOXELDER	2	1
SNAKEWEED SPECIES	2	
WHITE FIR	2	
ENGELMANN SPRUCE	2	1
BEARDED WHEATGRASS	1	
SHORTAWN FOXTAIL	1	
BLUEJOINT REEDGRASS	1	1
SHOWY CHLORIS	1	
HORSETAIL SPECIES	1	

COMMON NAME	TOTAL OCCURRENCES IN 644 OBSERVATIONS	OCCURRENCES WHERE SPECIES PRODUCED OVER 15% OF THE VEGETATION
ALPINE TIMOTHY	1	
TUMBLEGRASS	1	
MILKWEED SPECIES	1	
BELLFLOWER SPECIES	1	
GOOSEFOOT SPECIES	1	
ECHINACEA SPECIES	1	
STICKY GERANIUM	1	
SNEEZEWEED SPECIES	1	
STICKSEED SPECIES	1	
CLASPING PEPPERWEED	1	
SWEETANISE	1	
SPEEDWELL SPECIES	1	
REDOSIER DOGWOOD	1	
GREENMOLLY SUMMERCYPRESS	1	
MALLOW NINEBARK	1	
RUSSET BUFFALO-BERRY	1	
ROCKY MOUNTAIN JUNIPER	1	

APPENDIX B, Section 5

LAND CLASSIFICATION RECONNAISSANCE (Circa 1924) 1/

The U.S. Geological Survey in 1924 classified lands of the Northern Great Plains into three use classes - lands productive under irrigation, by dry-farming, or by grazing. Dry-farming lands were subdivided into three subclasses; farming, farming-grazing, and grazing-forage lands. Grazing lands were subdivided into two subclasses; tillable and non-tillable. Land class definitions used by the USGS are given at the end of this section. The map, Figure 31, and the graph, Figure 52, summarize the Geological Survey finding.

U.S.G.S. Use Classes

1. Irrigation
2. Dry-farming
    - farming
    - farming-grazing
    - grazing-forage
3. Grazing
    - tillable
    - non-tillable

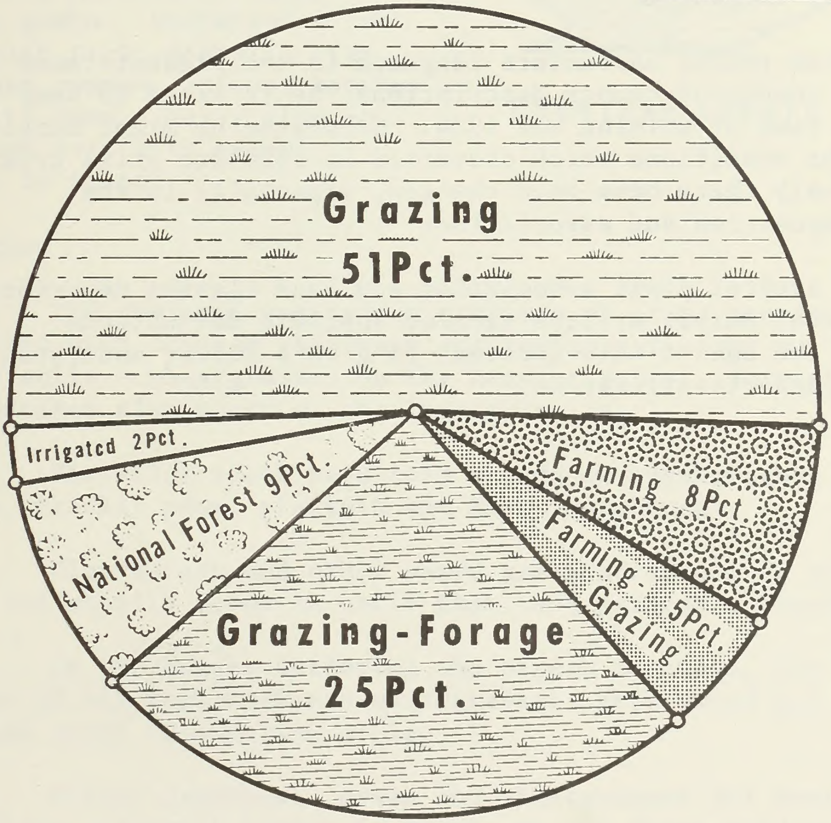


Figure 52

1/ Land Classification of the Northern Great Plains, Montana, North Dakota, South Dakota and Wyoming, U. S. Geological Survey 1929. Unnumbered

Range Vegetation in Land Classification (1924)

The Geological Survey divided vegetation into characteristic associations of forage or non-forage plants. In computing carrying capacity the Geological Survey estimated a grazing season of from five to seven months. Their figures, in animal units per section, are generalizations and have been converted in this report to the more common "acres per animal unit month" (A/AUM), to aid comparison with recent finding.

Land Classification by County (1924)

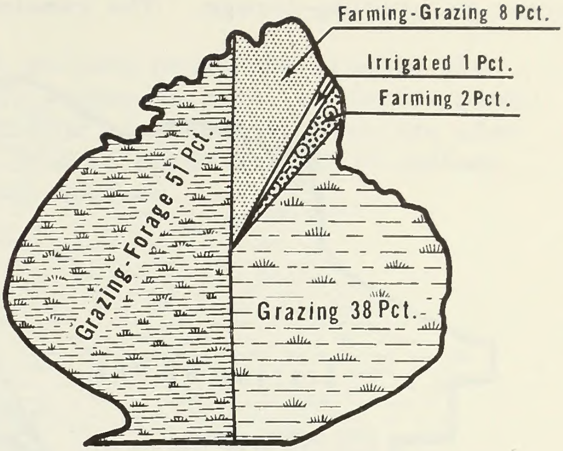
The following sections of the 1924 Geological Survey Land Classification report are reproduced because of their value for comparison with present day conditions. The original report used exceptionally long paragraphs; for ease of reading, the text herein has been reduced to shorter paragraphs, but the essential content remains unchanged.

As the reader encounters language in the present tense in the following county-by-county descriptions, he is asked to keep in mind that the time of writing was 1924. Otherwise he might conclude that all of the conditions which prevailed in 1924 are still true today. Obviously there have been changes, especially in the vegetative composition and associations

The several plant association and land classes described by the Geological Survey writers carried specific definitions reproduced at the end of this section, to give a fuller understanding of the early land classification.

CHOUTEAU COUNTY (1924)

The county contains 2,667,000 acres, of which one percent is classified as irrigated land, two percent as farming land, eight percent as farming-grazing land, 51 percent as grazing-forage land and 38 percent as grazing land. Not all of the county is in the Musselshell River Subbasin.



CHOUTEAU COUNTY

Soils

The dominant soil is a sandy to clay-loam glacial drift with patches of sand, clay or gumbo. Undrained slick spots with tight gravelly clay soils are common. Stream bottoms generally have a heavy clay or clay-loam soil with gravel present in places.

Vegetation

The dominant vegetation consists of grama grasses associated with fringed sagebrush and threadleaf sedge on the lighter soils - wheatgrasses on the heavier soils. Junegrass and needlegrasses also occur on the lighter soils.

The slick spots have thin stands of wheatgrasses, Russian-thistle, prickly pear, plantain and black sagebrush.

Club mosses and other weeds are scattered over the whole county but usually occur on soils that lack palatable vegetation.

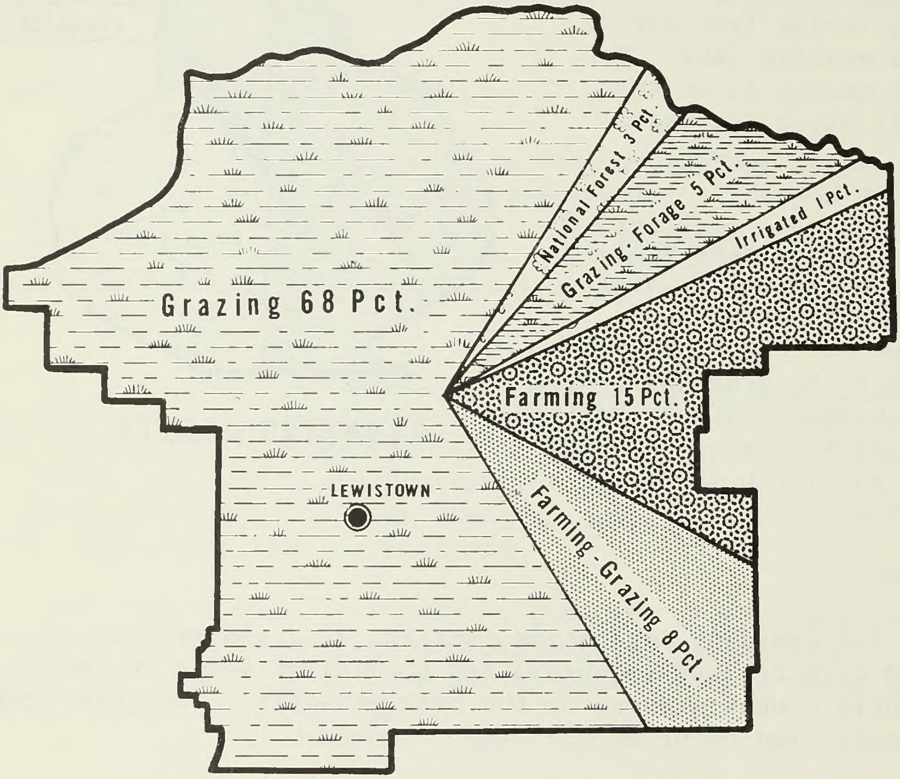
In the breaks bordering the stream channels, the vegetation consists of big sagebrush and wheatgrasses; greasewood and inland saltgrass occur on alkaline soils.

Silver sagebrush, grama and wheatgrasses are dominant in the valleys. Foxtail barley is common on the flats bordering the alkaline lakes in the Shonkin Sag. A narrow band of cottonwoods and willows occur along the larger streams.

At higher altitudes some coniferous trees and mountain vegetative types of grass and weeds are found.

FERGUS COUNTY (1924)

The county has 2,761,000 acres, of which three percent is in the National Forest. One percent is irrigated; 15 percent is farming land. Eight percent is classified as farming-grazing; five percent as grazing-forage. The remaining 68 percent is grazing land.



FERGUS COUNTY

Soils

The soil in the western part has a loamy texture, ranges from a few inches to three feet or more in depth, and overlies a mixture of limestone, gravel, sand and clay. The eastern part has clay or clay-loam soils underlain by shale and clay. In the flood plains, soils have varying textures but are mostly heavy clay loam or clay.

Vegetation

Western wheatgrass and grama grass are the dominant vegetation on the bench lands. On the light-soils, junegrass, western needlegrass, threadleaf sedge, slender wheatgrass, little bluestem, fringed sagebrush, silver sagebrush and big sagebrush are found.

In the mountain areas, shrubs dominate the lower slopes, and forests dominate the higher elevations. The chief shrubs are snowberry, rose, black chokecherry and Saskatoon serviceberry. The shrubs have an understory of bearded bluebunch wheatgrass, Kentucky bluegrass, western needlegrass, lupine, dock, arrowleaf balsamroot and wild geranium.

Forested areas have small scrubby ponderosa pine on the lower slopes. On the higher slopes, lodgepole pine, ponderosa pine and Douglas-fir occur. Scattered stands of ponderosa pine are also found in the river breaks. Partly open to dense stands of cottonwood and willow occur along the river-bottoms.

GOLDEN VALLEY COUNTY (1924)

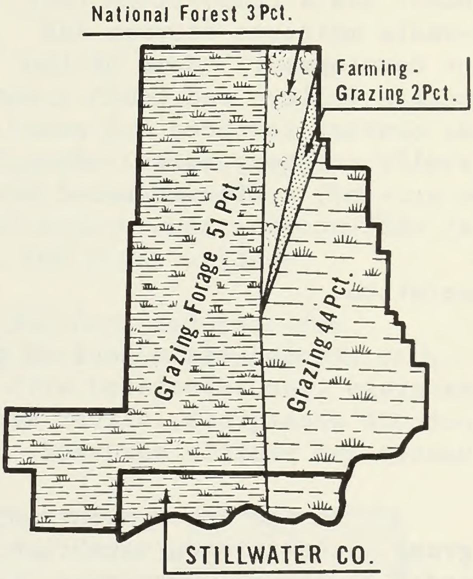
The county has 755,000 acres of which two percent is farming-grazing, 51 percent grazing-forage, 44 percent grazing land and three percent is in the National Forest.

Soils

The soils are mainly sandy and gravelly, but have enough loam to permit cultivation. They have, however, a low water holding capacity. The bottom lands along the drainages have heavy clay or gumbo soils.

Vegetation

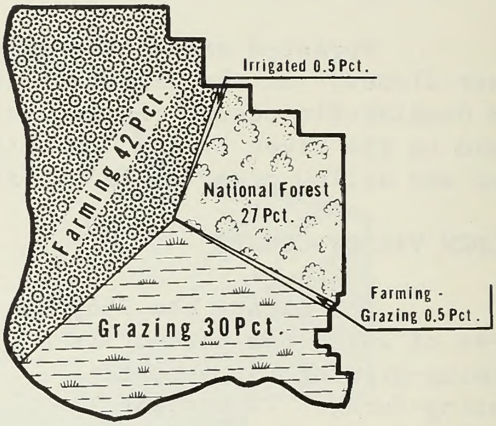
The dominant vegetation is grama grass and threadleaf sedge. Wheatgrasses and big sagebrush occur on areas with heavy soils. Associations of grama-fringed sagebrush, grama-wheatgrass, or a mixture of grama, threadleaf sedge, wheatgrasses, fringed sagebrush, cactus and big sagebrush occur on small areas.



GOLDEN VALLEY COUNTY

JUDITH BASIN COUNTY (1924)

The county has an area of 1,152,000 acres of which less then one percent is irrigated. Forty-two percent is classified as farming land; about 0.5 percent is farming-grazing land. Thirty percent is grazing land and 27 percent is in the National Forest.



JUDITH BASIN COUNTY

Soils

For the most part, the soil is clay loam over a subsoil composed of limestone gravel, sand and clay. The subsoil has a composition that prevents moisture storage and root development. Some of the mountain valleys and bench areas have coarser textured and even gravelly or stony soils. Along the streams, a fine-textured heavy clay soil occurs.

Vegetation

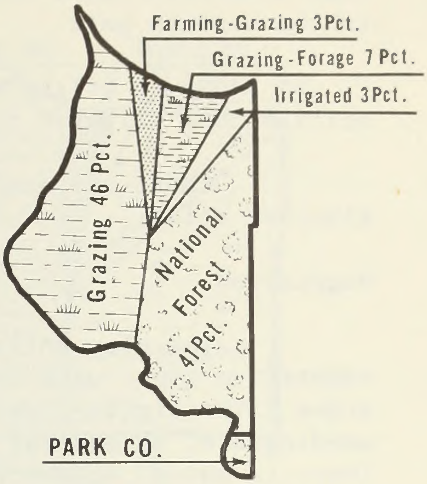
In the basin part of the county, is a grama-western wheatgrass type associated with junegrass, needlegrass, bearded bluebunch wheatgrass, silver sagebrush, threadleaf sedge, little bluestem and prairie sandreed.

On the lower mountain slopes in shallow gravelly soils, a grama grass-fringed sagebrush type occurs along with needlegrasses, bearded bluebunch wheatgrass, Kentucky bluegrass, mountain weeds, and scattered black sagebrush.

Forested areas have stands of ponderosa pine, Douglas-fir, and lodgepole pine. These are interspersed with open grasslands supporting giant wild rye and other grasses, together with wild geranium, lupine, and arrowleaf balsamroot.

MEAGHER COUNTY (1924)

The county has 1,527,000 acres of which three percent is irrigated. Three percent is classified as farming-grazing land, seven percent as grazing-forage and 46 percent as grazing land. Forty-one percent is in the National Forest. Not all of the county is in the Musselshell River Subbasin, accounting for the reduced area of the accompanying map.



MEAGHER COUNTY

Soils

The soil ranges from a fine-textured clay loam to a coarse sandy loam and gravelly loam.

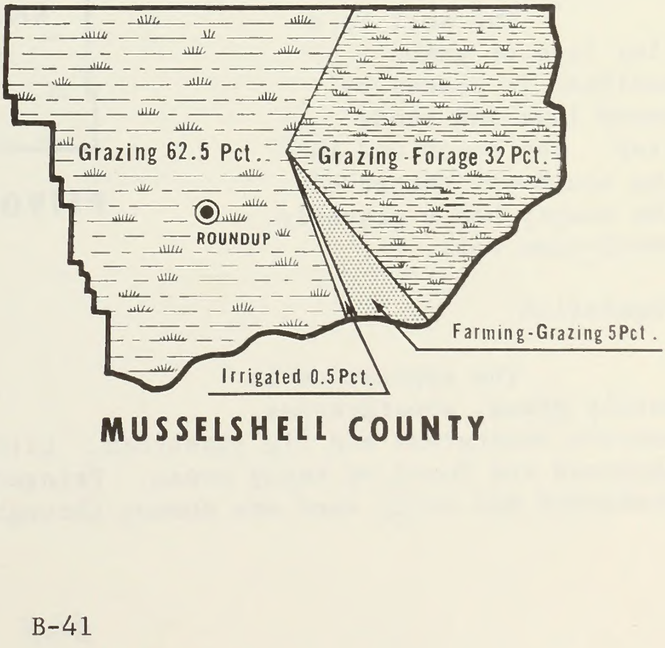
Vegetation

The valley and bench lands are predominately a sagebrush type. Grama-broom snakeweed, grama-western wheatgrass and grama-fringed sagebrush associations are also conspicuous. On the outer margins, the sagebrush type is modified by bearded bluebunch wheatgrass, wild geranium, lupine, arrowleaf balsamroot, and giant wildrye.

A forest type occurs above 6,500 feet and includes ponderosa pine, lodgepole pine and Douglas-fir in association with grasses and weeds.

MUSSELSHELL COUNTY (1924)

The county has 1,200,000 acres, of which less then one percent is irrigated. Five percent is classified as farming-grazing land; 32 percent is grazing-forage land. Sixty-three percent is grazing land.



Soils

North of the Musselshell River, the soil is generally clay or clay loam with local areas of sandy loam. Considerable gravel occurs in the western part.

South of the Musselshell River, both loam and sandy-loam soils occur; lighter soils follow the ridges.

There are numerous poorly drained areas with strong alkaline soils.

Vegetation

The clay soils support a western wheatgrass-big sagebrush vegetative type, with inland saltgrass and greasewood on alkaline areas. The lighter, sandy soils have grama grasses, western needlegrass, threadleaf sedge, junegrass and wheatgrasses. Where there is enough moisture, silver sagebrush occurs on deep soils.

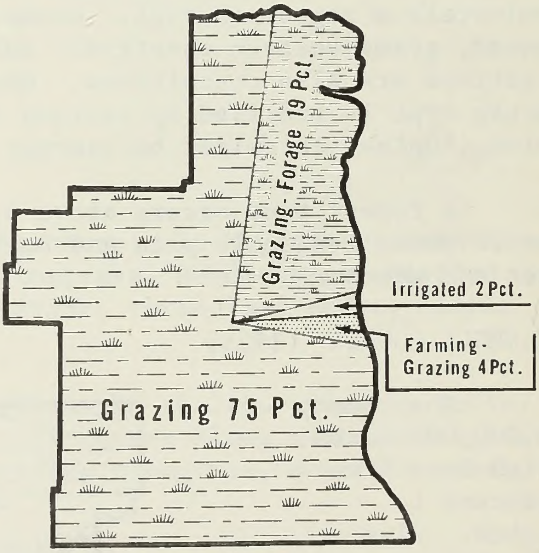
Scattered stands of small limber pine are found south of the Musselshell River and on the broken areas north of the river, and on the eastern boundary.

PETROLEUM COUNTY (1924)

The county has 1,078,000 acres, of which two percent is irrigated. Four percent is classified as farming-grazing land, 19 percent as grazing-forage land and 75 percent as grazing land.

Soils

The soil is a clay loam or gumbo modified in places by sandy loam and sandy clay. The benchland in the southwest corner of the county has a gravelly, sandy-loam soil.



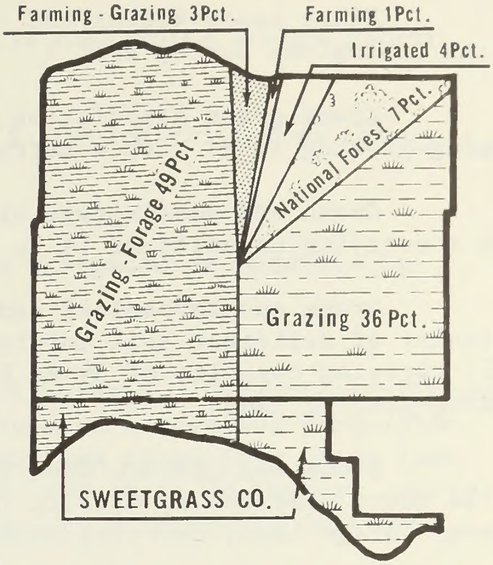
PETROLEUM COUNTY

Vegetation

The vegetation is mainly grama, wheatgrasses, western wheatgrass and big sagebrush. Little bluestem and prairie sandreed are found on sandy areas. Fringed sagebrush, broom snakeweed and crazy weed are common throughout.

WHEATLAND COUNTY (1924)

The county has 909,000 acres, of which four percent is irrigated. One percent is classified as farming land, three percent as farming-grazing, 49 percent as grazing-forage and 36 percent as grazing land. Seven percent is in the National Forest.



WHEATLAND COUNTY

Soils

The dominant soil type is a gravelly clay loam. In the central part of the county, gravel is so predominant as to prevent cultivation. Higher rainfall in the northern and southwestern parts of the county creates a more productive environment. Parts of the Musselshell River flood plain have a silt-loam soil.

Vegetation

The principal vegetation types are grama-wheatgrasses, grama-threadleaf sedge, and fringed sagebrush. A big sagebrush type occurs in the western part of the county on well-drained loam soils. The sagebrush has a dense understory of timothy, bearded bluebunch wheatgrass, lupine, crazy weed, arrowleaf balsamroot, and common yarrow. Ponderosa pine occurs along the margins of the larger streams and at higher altitudes.

Plant Associations - Definitions U. S. G. S. (1924)

Plant associations and their characteristics as described by the Geological Survey are: 2/

Grama grass association, a short-grass type found on the farming-grazing land, with a carrying capacity of 3½ to 6½ A/AUM.

Grama and needlegrass association, a more productive type, with a carrying capacity of 1½ to 3½ A/AUM.

Grama and threadleaf sedge association, an important indicator of deficient soil moisture on shallow, rocky or gravelly soil; carrying capacity of 3½ to 6½ A/AUM, and usually classed as farming-grazing land.

Grama and western wheatgrass association, characteristic of the heavy clay loams, usually indicating farming-grazing or grazing-forage land; carrying capacity of 2½ to 4 A/AUM.

Grama and fringed sagebrush association, on soils with more moisture then required for grama grass along; classed as farming-grazing land with carrying capacity of 3½ to 7 A/AUM.

Grama and broom snakeweed association, generally found on the tillable grazing land, with carrying capacity of 6½ to 12 A/AUM

Grama and silver sagebrush association, on deep, well drained soils capable of cultivation; carrying capacity of 2½ to 4 A/AUM.

Grama and buffalo grass association, similar to grama grass alone; crop failure during years of less than average rainfall; carrying capacity of 4 to 6½ A/AUM.

Grama, buffalo grass and western wheatgrass association, usually found on the farming-grazing or grazing-forage land; carrying capacity of 4 to 6½ A/AUM.

Western wheatgrass association, carrying capacity of 5½ to 6½ A/AUM.

Sagebrush association, classed as grazing-forage and grazing lands, with carrying capacity of 6 to 9 A/AUM.

2/ Currently accepted standardized plant names are substituted for U.S.G.S. plant names for uniformity.

Forest associations, provides occasional grazing, but considered to be of low carrying capacity.

Salt grass associations, soils containing enough alkali to prevent dry land crop production.

Definitions of Land Classes Used by U.S. Geological Survey Land Classification (1924)

Irrigated and Irrigable Land:

Deep soils that are actually irrigated or potentially irrigable.

Dry-farming Land:

Dry-farming land has a smooth surface. Climatic conditions, soil texture, and fertility are favorable to successful production of grain crops in most years. Soil textures range from sandy loam to clay loam; minimum precipitation is from 14 to 20 inches. Fifty percent or more of the precipitation occurs from May to September; the growing season is 100 to 120 days.

Farming-Grazing Land:

Farming-grazing land has a smooth to gently rolling surface. Climate, soil texture, and fertility are favorable to the successful production of grain crops 75 percent of the time, but yields are minimum; precipitation is from 12.5 to 17 inches; 50 percent or more of the total precipitation occurs during the six month period from April to September. On this land, a farmer can make a livelihood every year and a moderate profit two out of every three years.

Grazing-Forage Land:

Grazing-forage land has a smooth to gently rolling surface. Climate, soil texture, and fertility are such that grain crops can be produced only occasionally. Soils in this classification have a friable texture but are a clay or coarse-sandy to gravelly type, incapable of readily absorbing or retaining moisture. Normal rainfall ranges from 10.5 to 13 inches Wheat or rye, cut green for hay, is considered to be the only sure crop. Most of this area will always be used for livestock grazing.

Grazing Land:

Grazing lands are divided into two classes; tillable and non-tillable. Tillable grazing lands are smooth and physically tillable, but because of low rainfall or heavy or shallow soil, are unfit for cultivation. Non-tillable grazing land includes all remaining land that can be used only for grazing or timber production, such as, gravel terraces, rough broken mountain slopes and plains dissected by erosion into rough breaks and badlands.

Missouri River Bottom-land:

River bottom-lands are the alluvial plains formed by deposition as the river flows between nearly parallel lines of bluffs. Soil textures vary from very fine loam to sand. The sub-surface is usually saturated with ground water. Most of this land, especially the better types, are irrigated.

Stony Land:

Stony lands are areas of level to gently rolling land with a surface mantle of glacial debris. Stones or boulders, three to five inches or larger, prevent all uses but grazing.

UNITED STATES NATIONAL ATLAS
(Potential Natural Vegetation)

The Department of the Interior, at the time of publication of this report, is in the midst of preparing a National Atlas of the United States. Sheet 90 of this Atlas is reproduced as Figure 53 for that part which covers the Musselshell Area.

The Association of vegetation and the major species are as follows:

Western Spruce-Fir Forest (Picea-Abies)

Physiognomy:	Dense to open forests of low to medium tall needleleaf evergreen trees; open forests with a synusia of shrubs and herbaceous plants
Dominants:	Subalpine fir (Abies lasiocarpa) Engelmann spruce (Picea engelmannii)
Other Components:	Kinnikinnick (bearberry), heartleaf arnica, bluejoint reedgrass, sedges, rusty menziesia, whitebark pine, aspen, Douglas-fir, russet buffaloberry, white snowberry, whortleberries, common beargrass.

Douglas Fir Forest (Pseudotsuga)

Physiognomy:	Medium dense forest of medium tall needleleaf evergreen trees
Dominants:	Douglas fir (Pseudotsuga menziesii)
Other Components:	Mallowleaf ninebark, lodgepole pine, ponderosa pine, aspen.

Eastern Ponderosa Forest (Pinus)

Physiognomy:	Medium dense to open forest of low to medium tall needleleaf evergreen trees with a fairly open ground cover of grasses
Dominants:	Ponderosa pine (Pinus ponderosa)
Other Components:	Bluestem (western) wheatgrass, blue grama needleandthread.

Sagebrush Steppe (Artemisia-Agropyron)

Physiognomy: Dense to open grassland with dense to open shrub synusia

Dominants: Bluebunch wheatgrass (Agropyron spicatum)
Big sagebrush (Artemisia tridentata)

Other Components: Black sagebrush, arrowleaf balsamroot, Idaho fescue, pucoon, silky lupine, Indian ricegrass, phlox, Nevada bluegrass, Sandberg bluegrass, bitterbrush, squirreltails.

Foothills Prairie (Agropyron-Festuca-Stipa)

Physiognomy: Open to fairly dense grassland of usually rather short grasses

Dominants: Bluebunch wheatgrass (Agropyron spicatum)
Idaho fescue (Festuca idahoensis)
Rough fescue (Festuca scabrella)
Needleandthread grass (Stipa comata)

Other Components: Common yarrow, bluestem (western) wheatgrass, fringed sagebrush, blue grama, threadleaf sedge, buckwheats, prairie junegrass, beardtongues, Sandberg bluegrass.

Grama-Needlegrass-Wheatgrass (Bouteloua-Stipa-Agropyron)

Physiognomy: Rather short, open to fairly dense grass

Dominants: Western wheatgrass (Agropyron smithii)
Blue grama (Bouteloua gracilis)
Needleandthread grass (Stipa comata)

Other Components: Bearded bluebunch wheatgrass, little bluestem, fringed sagebrush, threadleaf sedge, hairy goldaster, broom snakeweed, prairie junegrass, dotted gayfeather, stonyhills muhly, Sandberg bluegrass, sand dropseed, green needlegrass

Wheatgrass-Needlegrass (Agropyron-Stipa)

Physiognomy: Moderately dense, short or medium tall grassland

Dominants: Western wheatgrass (Agropyron smithii)
Blue grama (Bouteloua gracilis)
Needleandthread grass (Stipa comata)
Green needlegrass (Stipa viridula)

Other Components: Thickspike wheatgrass, pussytoes, fringed sagebrush, sedges, prairie junegrass, bluebells, Indian ricegrass, beardtongues, Falsetarragon sagebrush, louisiana sagebrush, heath aster, blacksamson echinacea, dotted gayfeather, silverleaf scurfpea, goldenrods, porcupinegrass.

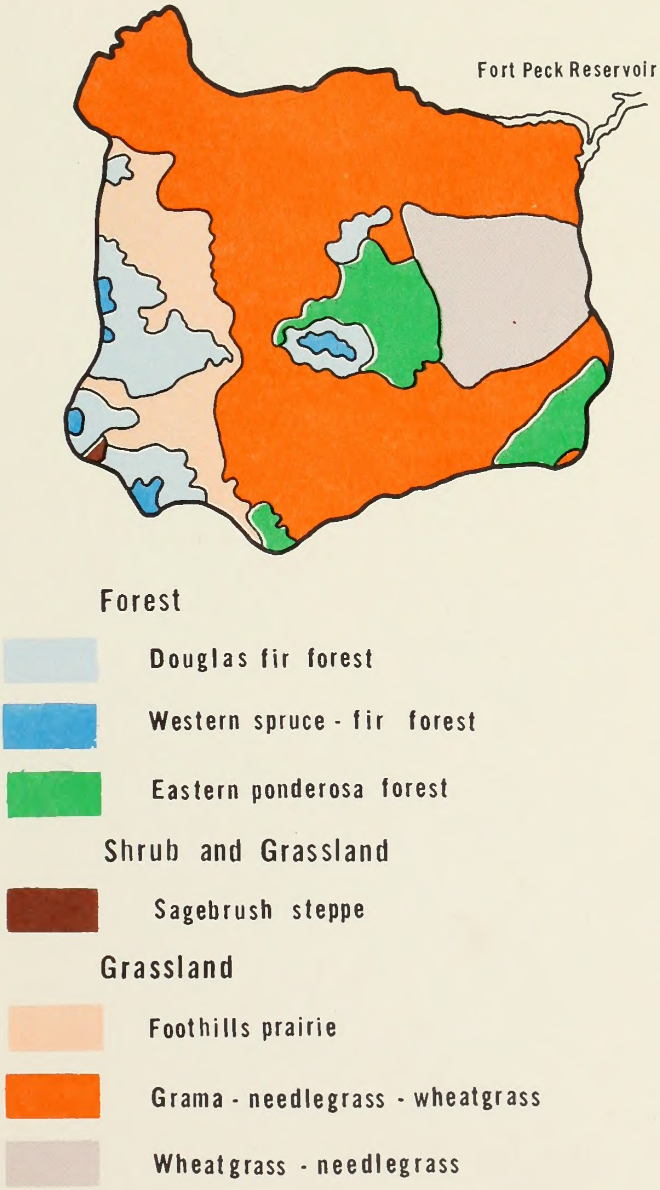


Figure 53

APPENDIX C

Section 1	Range Vegetative Types
Section 2	Method of Rangeland Inventory
Section 3	Sweetclover and Annual Plants

APPENDIX C, Section 1

RANGE VEGETATIVE TYPES

From BLM Manual

"Vegetative Types. The aspect vegetative types which are first used in mapping an area into range types are the same as the 18 standard types established some years ago.

"1 - Grass. Includes grassland other than meadow and secondary meadow. Perennial grasses predominate and determine the aspect, although forbs and shrubs may be present. Examples of types are: grama-buffalo grass, bunch grass, wheatgrass-sedge, alpine grassland, and blue stem.

'Where it is desirable to distinquish short and tall grass from mid-grass, these ecological variations may be designated, 1S-shortgrass and 1T-tall grass.

"2 - Meadow. Includes areas where sedges, rushes and moisture-enduring grasses predominate. Two classes of meadows are recognized: wet meadows and dry meadows.

"Wet meadow or marsh is characterized principally by sedges and remains wet or moist throughout the summer. These shall be designated as 2W.

"Dry meadow or flood plain is dominated by grasses rather than sedges and occur as moist meadowlike area or intermittent meadow, both of which become moderately dry by midsummer. These shall be designated as 2D.

"3 - Perennial forbs. Includes all untimbered areas where perennial forbs predominate over other classes of vegetation. There is very little true forb type, as a forb cover is usually more or less temporary in character and is soon replaced by a more permanent type if the disturbing factor is removed. If there is no great predominance of the forbs over the grass or shrub vegetation, and if it is possible to judge that the forb predominance is due to some unnatural factor, the forbs should be disregarded in designating the type and the more stable vegetation should be used as an index. The forbs will then be cared for in the subtype.

"4 - Sagebrush. This type includes all untimbered lands where sagebrush or shrubby species of similar character predominate. The sagebrush lands are usually of different range values and different in season of grazing from the areas which are listed below under mountain shrub. Areas dominated by shrubby species of sagebrush, including big sagebrush (*Artemisia tridentata*) shall be classed as subtypes, as for example: Artemisia filifolia, A. cana, and A. tripartita. Other shrubby species such as Chrysothamnus should be designated as subtypes when they become dominate in sagebrush areas.

"This and the mountain shrub type which follows are sometimes difficult to distinguish from the grass and forb types when aspect rather than the dominant class of forage is used as the distinguishing characteristic. Sagebrush may form only 15 percent of the total vegetation of a type and still its aspect may be that of a sagebrush type.

"It may prove desirable, in a given region, to decide on a certain percentage of all the vegetation in the type, say 20 percent, as the minimum proportion of sagebrush that may be present if the area is still to be classified as a 4 type, providing, of course, it does not already have the aspect of some other type. The same will hold true of the mountain shrub.

"5 - Mountain shrub. This type includes all untimbered lands where mountain shrubs, excepting sagebrush or its subtypes, gives the main aspect to the type or is the predominate vegetation. Characteristically it occupies the transition zone of the lower mountain slopes, foothill, and plateau areas. Examples of subtypes are mountain mahogany, bitter brush, willows, Ceanothus, manzanita, California chaparral, etc.

"6 - Conifer. This type includes all range in coniferous timber supporting grasses, forbs, or shrubs, either singly or in combination, except as provided under types 7 and 9. The forage may vary from a pure stand of pinegrass, or some other grass, to a pure stand of forbs or shrubs. It usually, however, consists of grasses, forbs, and shrubs, and the proportion of each species varies so widely that it is not thought advisable to attempt a division into types with distinct colors. These variations can best be represented by subtypes.

"7 - Waste. This type includes all areas of dense timber and brush which have no value for grazing domestic livestock or have such slight value that they cannot be used economically, owing either to denseness of standing or down timber or sparseness of forage growth. Large areas of very sparse forage, unless within easy reach of a better type, shall be classified as waste because of the impracticability of running stock over so large an area to get such a small amount of feed.

"This type also includes other waste areas not strictly in timber or brush and not barren, but so rough or inaccessible as to make their future use improbable.

"The subtype designations generally encountered in this type are as follows: 7T-waste in dense timber; 7D-waste in down timber; 7B-waste in brush; 7R-waste areas where rocky character prevents use; and 7I-permanently inaccessible areas. Principal species of timber should be shown by symbols.

"For any 7 type which is or can be used by game animals, the type number is modified by adding after the "7" designation the number (in parentheses) of the aspect vegetative type involved. This combination type number will indicate value for game forage and habitat.

"8 - Barren. This type includes all areas on which there is no natural vegetation, or practically none, including intermittent lake beds, saline flats, active sand dunes, shale, rock slides, lava flows, etc. Areas which have been denuded by overgrazing or other causes should not be confused with areas naturally barren, nor should areas containing only annuals for a part of the year be shown as "barren" although these may be without vegetation for the remainder of the year.

"9 - Pinon-juniper. This type includes pinon, juniper, pinon-juniper, and digger pine. The character of the range in this type as regards location, grazing capacity, and management is sufficiently distinct from the conifer type to justify a separate color. The forage may vary from a pure stand of grasses, forbs, or shrubs to a combination of any two or all. This variation can best be shown by subtype designations.

"10 - Broad leaf trees. This type includes all range in deciduous timber. The conbination of grasses, forbs, and shrubs, and the proportion of individual species, will vary as in other types.

"The principal subtypes which will be encountered are: aspen, cottonwood, oak, birch, alder, ash-elm, etc., when they occur in tree form.

"13 - Saltbush. This type includes areas where the various salt desert shrubs of the *Atriplex* genus form the predominant vegetation, or give the characteristic aspect. There is sufficient significant difference in the range value and the use of saltbush areas to justify their separation from other desert or semi-desert shrub types.

"14 - Greasewood. This type includes areas where greasewood (Sarcobatus) is the predominant vegetation or gives a characteristic aspect. Usually this type occupies valley floors subject to overflow during flood periods or areas underlain with ground-water at shallow depths where the soil is more or less saline. It is sufficiently differentiated from other desert shrubs to justify an exclusive type.

"15 - Winterfat. This type includes areas where winterfat (Eurotia) gives a characteristic aspect or constitutes the predominant vegetation. Though commonly associated with other semi-desert shrubs, the occurrence of this plant in Utah and Nevada as a type character is of sufficient extent to justify a separate type.

"16 - Desert shrub. This is a general type which includes areas where other desert shrubs aside from those separated into individual types, constitute the predominant vegetation or give the characteristic aspect. This type includes several genera which are quite distinctive in type habit such as black brush (Coleogyne), coffee berry (Simmondsia), catclaw (Acacia or Mimosa), gray molly (Kochia), hopsage (Grayia spinosa), and spiny horsebrush (Tetradymia spinescens), but pure types of each are too limited in extent to justify separate types. The plant symbols used will be sufficient to indicate the predominant species present.

"17 - Half shrub. This type includes areas where half shrubs constitute the dominant vegetation or give the characteristic aspect.

'Half shrubs are semi-woody perennials of low stature such as Aplopappus, Gutierrezia, Artemisia frigida, Eriogonun wrightii, etc. They commonly consist of a woody caudex from which herbaceous stems are produced that die back annually. These genera are sufficiently distinctive in habitat and of wide enough extent in certain localities to justify a separate type designation.

"18 - Annuals. This type includes areas in which annual forbs or annual grasses constitute the dominant vegetation. Both transitory stages and semipermanent conditions should be included in this type as for example: russian thistle, downy chess (Bromus tectorum), and desert forbs. The plant symbols used will be sufficient to indicate the predominant species present."

APPENDIX C, Section 2

METHOD OF RANGELAND INVENTORY

The ecological method of range inventory was used in the Musselshell River Subbasin. This system describes the rangeland's potential production in terms of amount and kind of forage. Present production can then be compared to the potential.

The ecological method of range classification depends on two essential concepts. The first concept is that of the range site. The second concept is that of the climax plant community.

Range Sites

Each range site is described in terms of soil depth, soil texture, topography, parent materials, alkalinity or acidity, stoniness, slope, exposure and organic matter. Range sites are so stable as to be nearly permanent, due to the relatively unchanging character of such component elements as topography, degree of rockiness, etc..

Plant Communities

The regional climate, modified by each range site's environment, develops characteristic and unique plant communities. When the range site and its plant community are modified in some way, such as an increase of soil fertility or a decrease in light intensity, some plants may be favored more than others. One plant species may replace another species; or one plant community may replace another community and this second community in its turn may be replaced by a third. There is a series of stages moving towards a climax community. The final stage, the climax, persists as long as there is no change in the environment.

Within a particular climatic region, the stages of all plant communities tend towards one uniform climax plant community. For example, the tall grass prairie (big bluestem, switchgrass, indian grass) occurs on limestones, granites, clays and shales, floodplain deposits, sands and calcareous marls.

The range site itself can limit vigor and productivity of individual plants and composition of the plant communities. Saline or shallow soils may have plant communities that are entirely different from those found on undrained soils. These exceptions to the one-climax plant community are the basis for a range site.

Application

A guide for use by the range inventory field crew is prepared, as illustrated below. A guide describes both the range sites and plant communities for such large physiographic areas as the Montana Glaciated Plains covering one-third of the state. Descriptions of the range sites are usually easy to prepare. The descriptions of the climax plant communities are more difficult.

Figure 54 Field Guide

DECREASERS		INCREASERS (By Range Sites)	Maximum Percent by Dry Weight Produced Annually in Climax														INVADERS (Less than 2½% in Climax)
			Sa	Sv	Sy	Si	Cy	TSy	TSi	TCy	SwC	SwG	SwL	SwN	Ps	DC	
Elci	Orhy	Agsm	5	30	30	d	d	d	d	d	d	d	d	d	d	d	Annual Plants
Spgr	Poca	Stco (1)	25	20	45	40	-	45	40	-	-	d	d	d	d	-	Phpr
Sppe	Puai	Spcr	10	5	10	5	-	10	5	-	-	15	10	5	5	-	Popr
Caca	Pudi	Kocr	5	5	5	5	5	5	10	10	5	5	5	5	10	-	Sepa
Cain	Sedge decr.	Camo	-	5	5	5	10	5	5	10	5	5	5	5	10	5	Musq
Elca	Forb decr.	Mucu	-	-	-	-	-	5	10	10	5	10	10	10	5	-	Hoju
Brma		Bogr	10	5	15	15	10	20	20	15	15	20	20	20	20	-	Arlo
Bran		Buda	-	-	-	-	5	-	-	5	-	-	-	-	5	5	Cael
Atca		Pose	-	-	-	5	5	-	5	5	5	5	5	5	5	5	Grsq
Pavi		Sihy	-	-	-	-	-	-	-	5	5	5	5	-	5	5	Gusa
Spai		Sedge incr.	5	5	10	5	5	10	10	10	10	10	10	10	5	-	Taof
Poar		Dist	-	-	-	-	-	-	-	-	-	-	-	-	5	-	CIRS
Agsp		Forb incr.	5	5	5	5	5	5	5	5	5	5	5	5	-	-	Arco (2)
Agsu		Eula	-	5	5	5	5	5	5	5	-	d	d	d	d	d	Amar
Agin		Atnu	-	-	-	5	5	-	5	5	10	-	5	-	10	-	CHRY
Agtr		Artr	-	-	-	-	5	-	5	5	5	-	-	-	5	5	
Anha		Atca	5	-	-	5	-	-	5	-	-	-	-	-	-	-	
Ange		Save	-	-	-	-	5	-	-	-	5	-	-	-	5	5	
Ansc		Conifers	-	10	-	-	-	-	-	-	5	-	5	5	-	-	
Bocu		Other woody increasers	10	5	5	5	-	5	5	-	-	-	5	5	-	-	
Hemo		Musq	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

The climax plant community for a range site is found by searching for protected or relatively undisturbed rangeland. The plant community of the least disturbed range sites is accepted as representing the vegetative potential. In addition, grazing district records, experiment station ranges, scientific literature and historic accounts are investigated. The evidence from any one source is not regarded as conclusive - all must be considered.

Because the range sites vary, each plant species has a broad range for its portion of the total plant community. For example, range sites with similar soils and topography may vary in forage production because of differences in annual precipitation.

Although the plant composition may be temporarily changed by drought, grazing, fire or farming, range sites are permanent; their climax plant communities, if disturbed, will re-establish. Sometimes the disturbance is so drastic that the range site is permanently changed. Farming, for example, may be so prolonged as to change the original range site by excessive soil erosion. A new range site with its altered potential is then described. (Range sites are named, from the physical character of the site, i.e., Badlands, Saline Uplands, etc..)

Range Condition

In practice, the range condition is found by listing the relative quantities of plants. This is compared with the climax plant community of the range site. Differences are described in four classes; "Excellent", "Good", "Fair", and "Poor". (Note: These descriptions are not ideal, and could lead to misinterpretation of the inventory's results if their use were not understood. For example,"Badlands"are poor because they produce very little forage, but they are usually in"Excellent"ecological condition. These descriptive class words are so widely used in range management literature, that their use is retained despite their shortcomings.) Range condition classes show the degree to which the present plant community varies from the climax plant community.

Changes from the climax plant community are stated by percentages because the forage is harvested by animals that are selective and exhibit palability preference. A range site grazed by sheep will lose weeds and browse plants, and become more of a grassland. Cattle use will result in less grass and more weeds and brush. Antelope and deer will remove more of the shrubby species. All of these changes from the climax are expressed by percentages rather than by unwieldy narrative description.

Volume production, the amount produced by each species, is estimated to the nearest five percent for present and climax plant communities. This includes all photosynthetic surfaces. Prickly pear, for example, will have succulent pads many years old, which compete for light and water. On the other hand, only the leaves and the current annual growth of twigs is estimated for sagebrush.

Plant Community Reactions in Determining Range Conditions

The climax community's vegetation is divided into decreaser, increaser, and invader plants. These groups represent the plant's reaction to heavy grazing pressure. Under continued heavy use; (1) decreaser plants slowly disappear and (2) increaser plants replace the decreasers. Increaser plants have a limit in the climax community; they can spread into available space only after the decreaser plants dwindle away. Under heavy grazing, low value increaser plants usually seize territory faster than those of higher value. This limit on increaser plants in climax vegetative communities is the key in making calculations. Using the plant guide for the range site, a limit is found for each increaser plant; any excess to that limit is disregarded.

The following field tablet page illustrates the computations used to arrive at a numerical value for range condition.

Range Site & Condition Write-up
(Ecological Site Method)

Date July 10, 1970

Plot No. S-2 Examiner John Smith

T 3N R 49E Sec 14 P.M. Mont. (V)

1 Annual Bromes CAREX Agsm F ← 7.1 45%

Tcy VIII C 1-1-1 3 F 2 FYZ 3

Present Composition			Climax
Species		%	% Usable
Grasses	Bogr	10	10
	CAREX	15	10
	Agsm	10	10 ← (I)
	Stco	5	
	Calo	T	
	Agsp	10	10
	Brte Brja	20 ←	(III)
	Fuoc	5	
	Pose	10	5 ← (II)
	Hoju	T	
Forbs	Plan Arfr	5	
	PSOR Weeds	5	
Shrubs	Arca	T	(IV)
	Artr	T	
	YUCC	T	
Total		100%	45 -%
			Condition

Steps in Calculation

I. Total the percent of all decreaser plant species. (Decreaser plant species are in the guide for each range site.)

II. Total the present quantity of increasers, but only to the limit for each species in the climax community. Any excess is disregarded. (Increaser plant species and their limits are in the guide for each range site.)

III. Disregard all invader species (Annuals and noxious weeds)

IV. Total the two amounts - decreaser plants plus allowable quantities of increaser plants.

V. Compute the score.

0 to 25 percent - "Poor"
25 to 50 percent - "Fair"
50 to 75 percent - "Good"
75 to 100 percent - "Excellent"

If grazing pressure is continued or increased, invaders will move into the plant community as the increasers begin to disappear. Invaders are not a part of the climax and cannot enter into any calculations. They may be present, for example, as sunflowers on raw soil at a prairie-dog burrow, but the five percent increments in estimating forage eliminates their consideration.

Results

Management is not based on high range condition scores; it depends on the kinds of plants found on the range. Spring range with annual grasses might be far from the original plant community for the site, yet meet the exact needs for economic management. The ecological system of range inventory uses the original plant community as a benchmark to which the ever-changing rangelands can be compared. Goals can be envisioned and results forecast by the use of the two concepts, range sites and climax plant communities.

Sweetclover and Annual Plants

In estimating the carrying capacities of native ranges, care must be taken to avoid excessively high ratings resulting from a temporary superabundance of annual and biennial plants. The most conspicuous and useful of these plants is the biennial sweetclover, in its yellow and white varieties. Of the annuals, the most common are annual bromegrass and the sunflower.

It has been found that an exceptional growth of a biennial species frequently occurs during the season following a year of greater than average rainfall. During the summer of 1963, an exceedingly heavy cover of yellow sweetclover was found over widespread areas of the Musselshell drainage. This occurrence was attributed to a combination of favorable precipitation in 1962, and a heavy seed production year in 1954.

The conspicuously growing sweetclover was abundant throughout the northern Musselshell drainage, especially near Roy. Precipitation at Roy the previous year measured 23 inches, an excess of 40 percent over the annual average of 12½ inches. Local residents clearly recalled an abundance of yellow sweetclover in 1954. Precipitation records show that 1953 was an exceptionally high moisture year. It is known that seed production by yellow sweetclover is heavy, and that the seeds remain viable for many years. Seeds lying dormant from the production of 1954 probably germinated in response to the rainfall of 1962. During 1962, low, strong leaf crowns were produced. Then in the following year, due to the biennial nature of the species, larger plants with many stems, leaves and flowers grew in abundance.

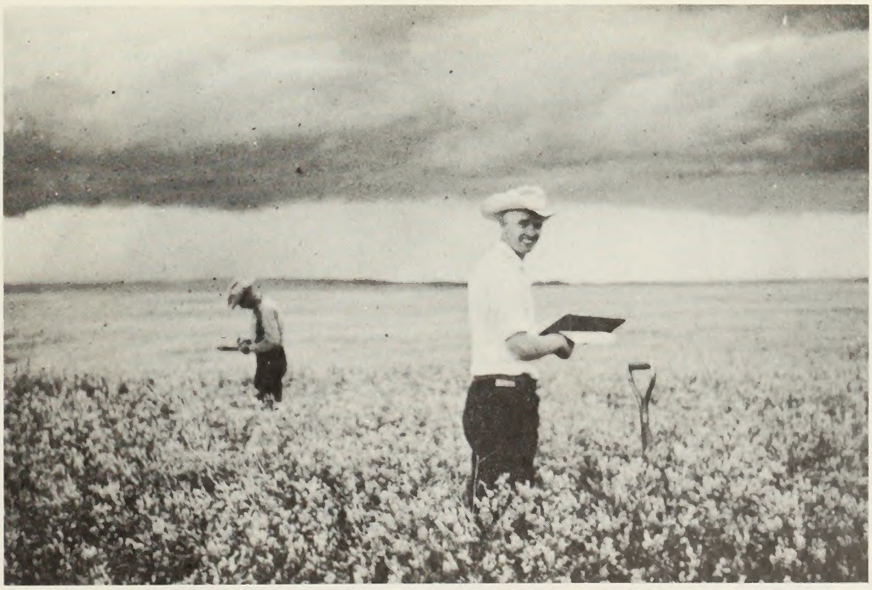


Figure 55 Photograph showing the density of yellow sweetclover in an ungrazed pasture seven miles north of Roy, Montana.

Annual plants have also been often observed growing in overabundance during wet years following a period of dryness. The most commonly occuring annuals are the bromegrasses. The bromes exhibited phenominal growth in the Tongue River area of Montana during the wet year of 1961. Extensive areas of western Kansas witnessed an infestation of annual sunflowers during 1957, which was the first wet year following a period of drought.

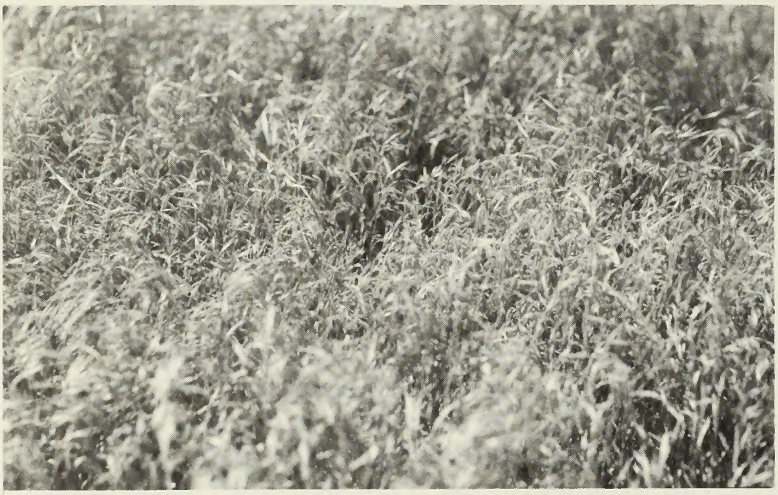


Figure 56 Closeup of ground cover of annual grasses

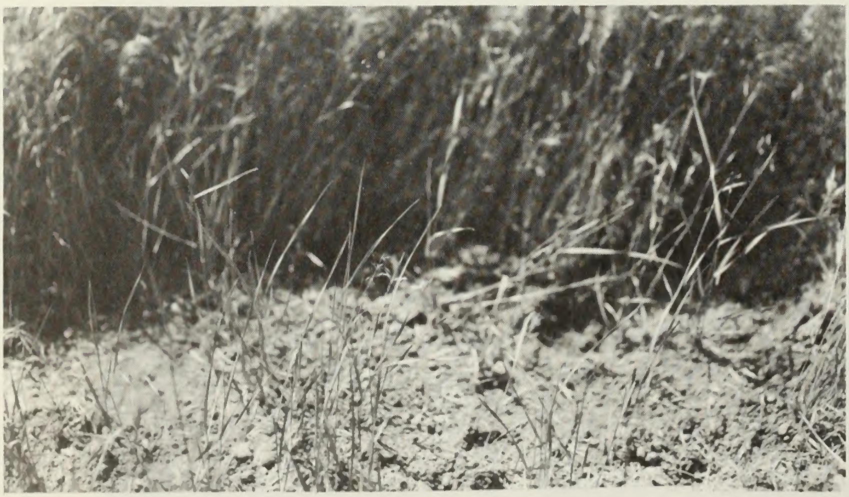


Figure 57 Camera position unchanged from figure above. Annual grasses removed to show the scattered perennials in the ground cover.

When the range examination crew encounters an exceptional growth of annuals or biennials on a normal perennial grass range, their estimates of carrying capacity must be adjusted to suit the phenomenon. Although great quantities of forage result from plant outbreaks in response to abnormal rainfall, the condition lasts but one year. For that reason, perennial vegetation is used to calculate carrying capacity. Livestock rates are set for long term land management and safe grazing practices. If the abnormal forage of an exceptional year were considered, the grazing rate would be set too high for average years. The resulting excess numbers of livestock would then damage or destroy the dependable perennial cover as they grazed the overcrowded ranges.

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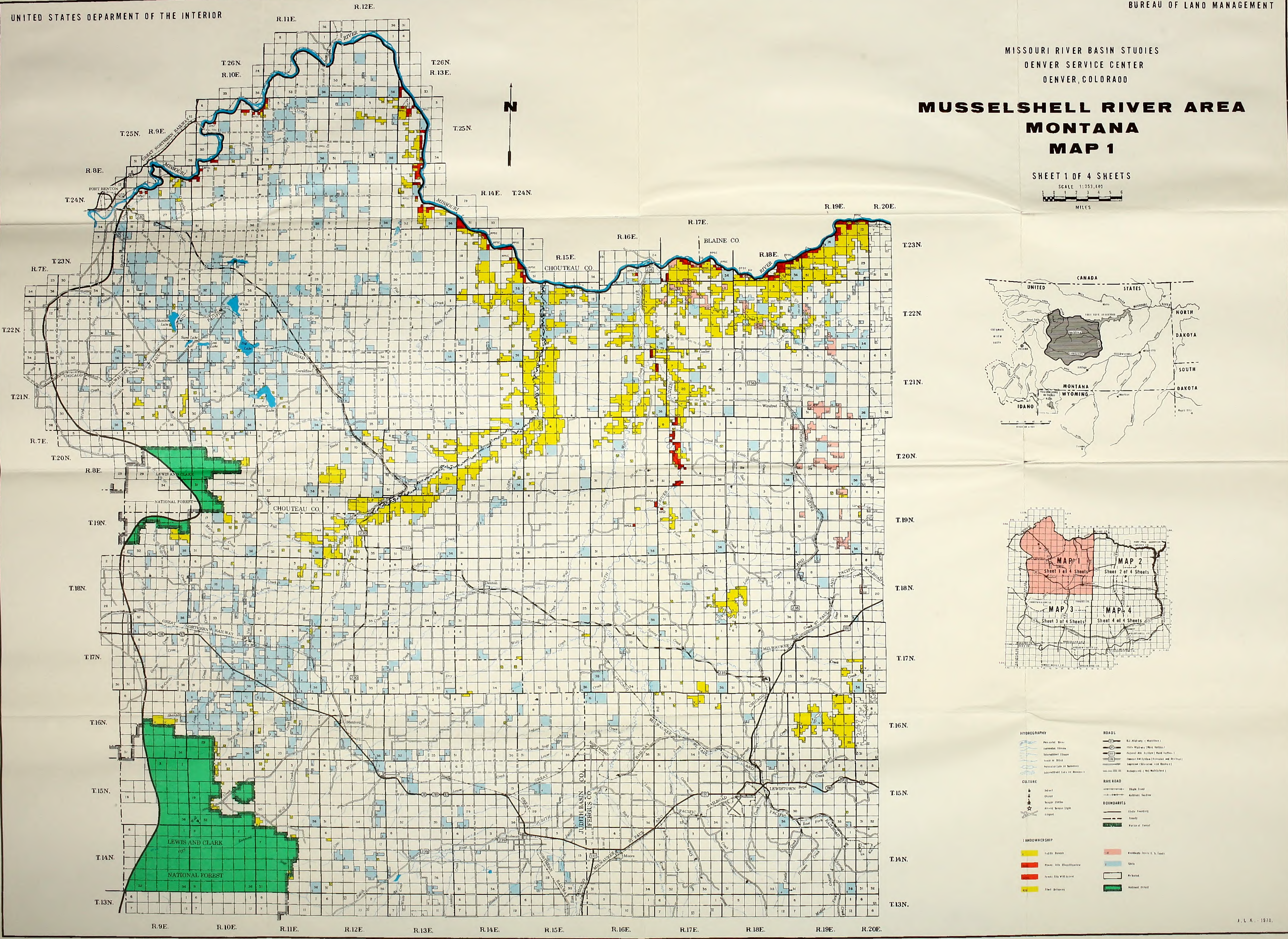
MUSSELSHELL RIVER AREA MONTANA MAP 1

SHEET 1 OF 4 SHEETS



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MUSSELSHELL RIVER AREA
MONTANA
MAP 2

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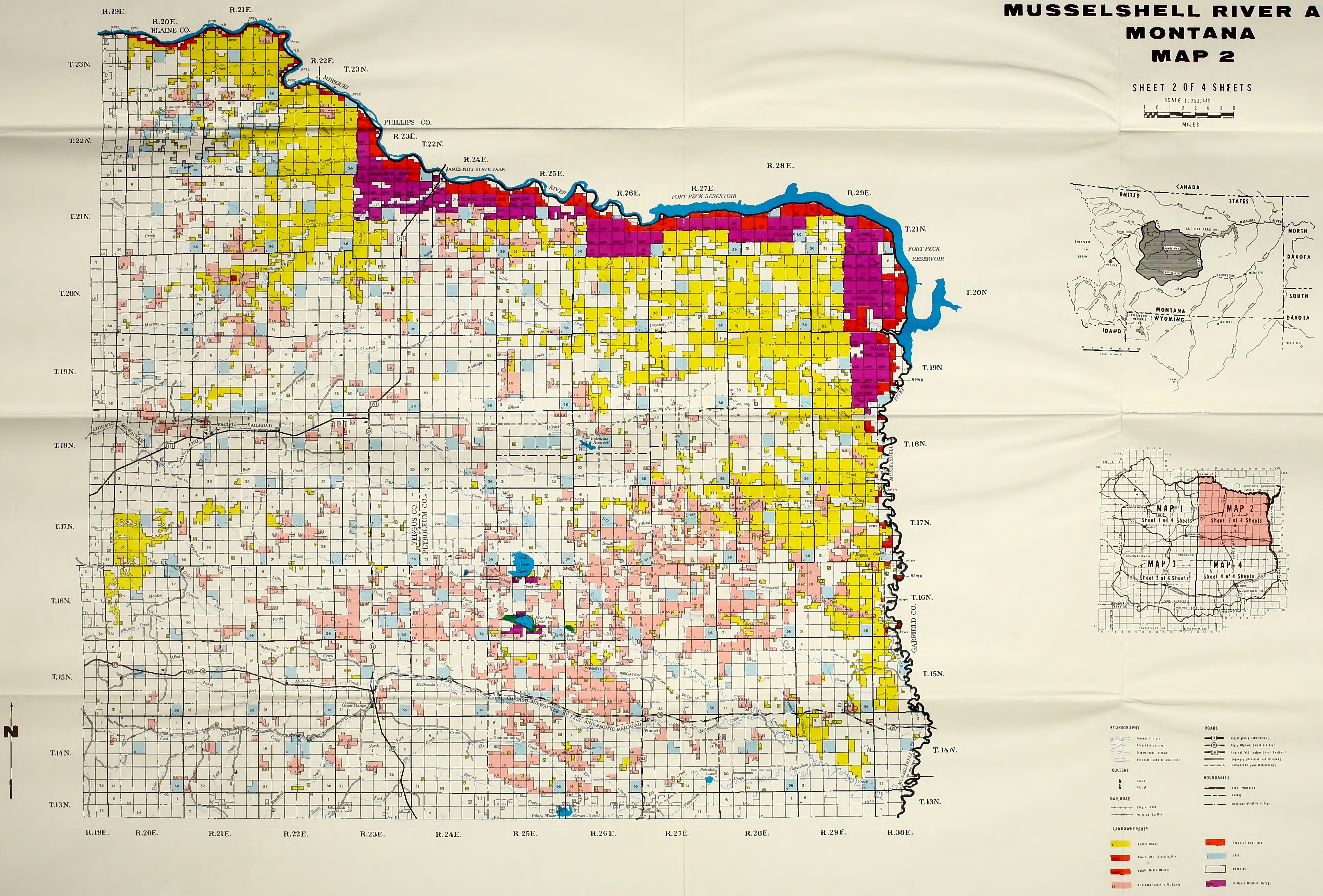

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MUSSELSHELL RIVER AREA
MONTANA
MAP 3

SHEET 3 OF 4 SHEETS

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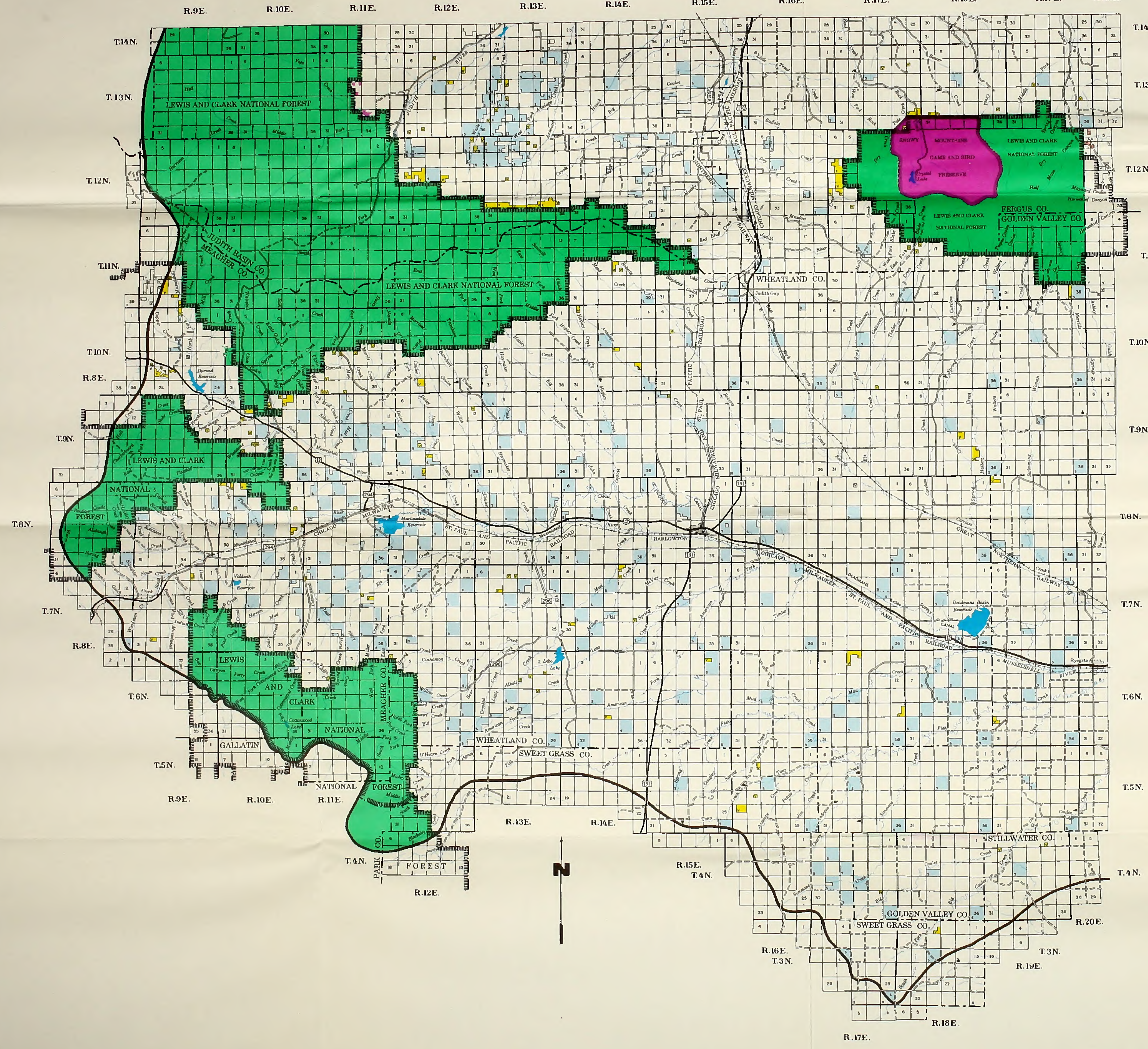

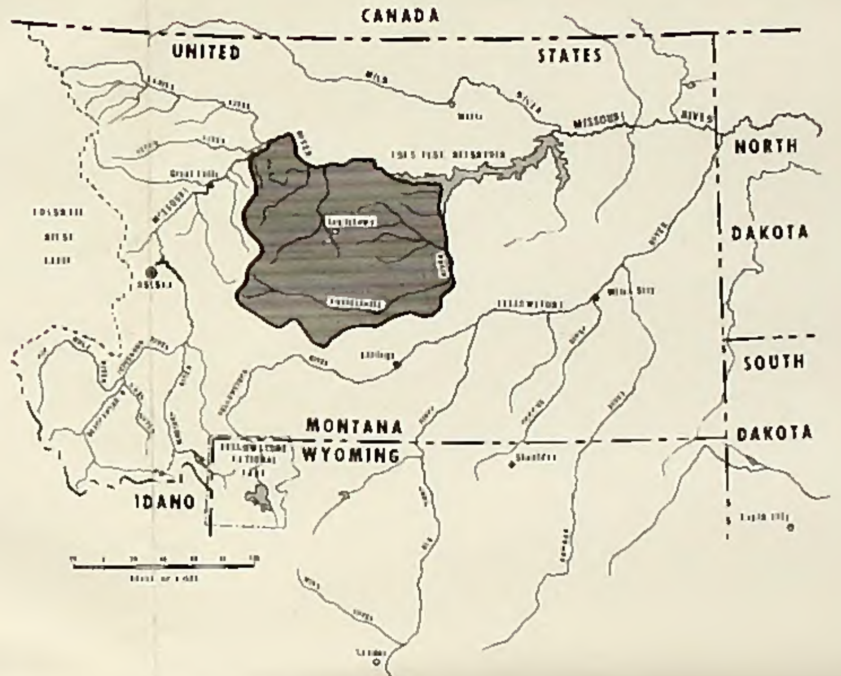

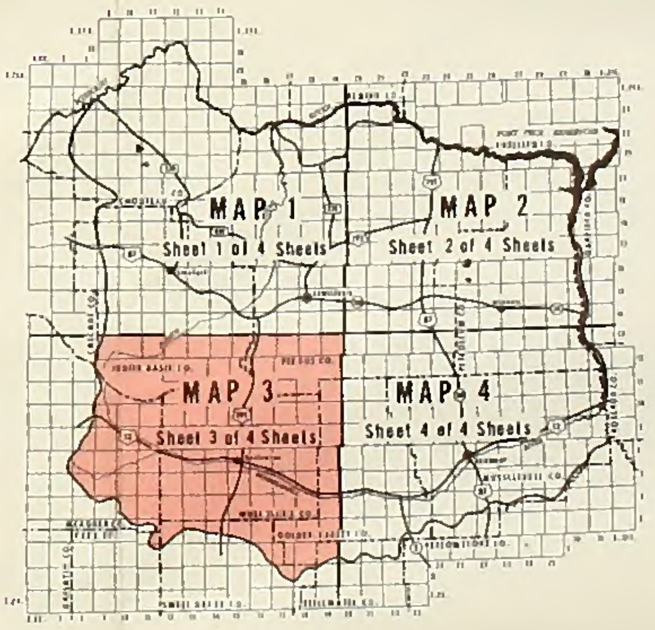

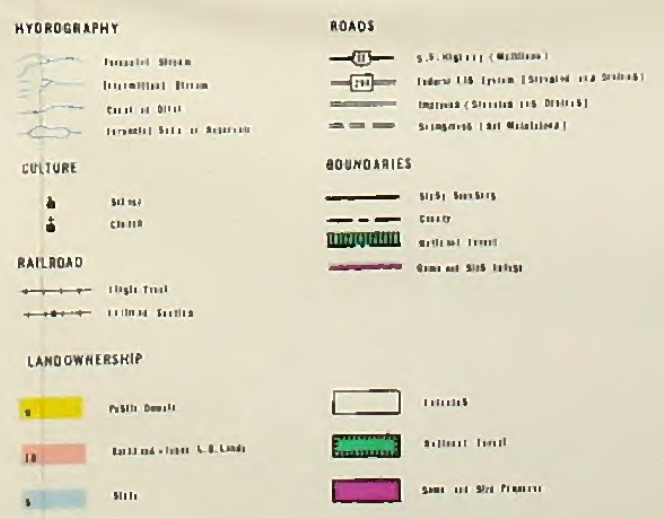

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MUSSELSHELL RIVER AREA
MONTANA
MAP 4

SHEET 4 OF 4 SHEETS

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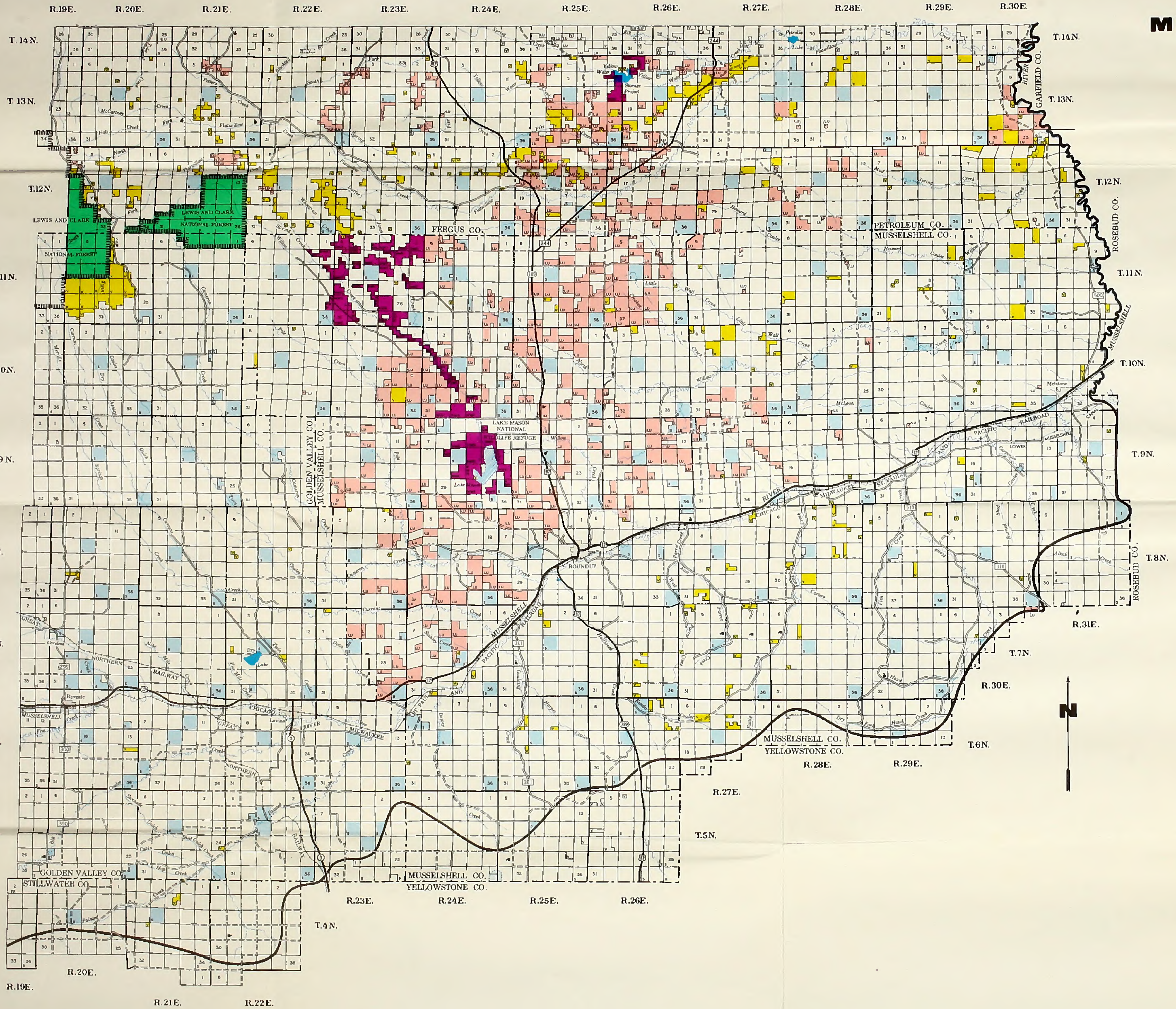

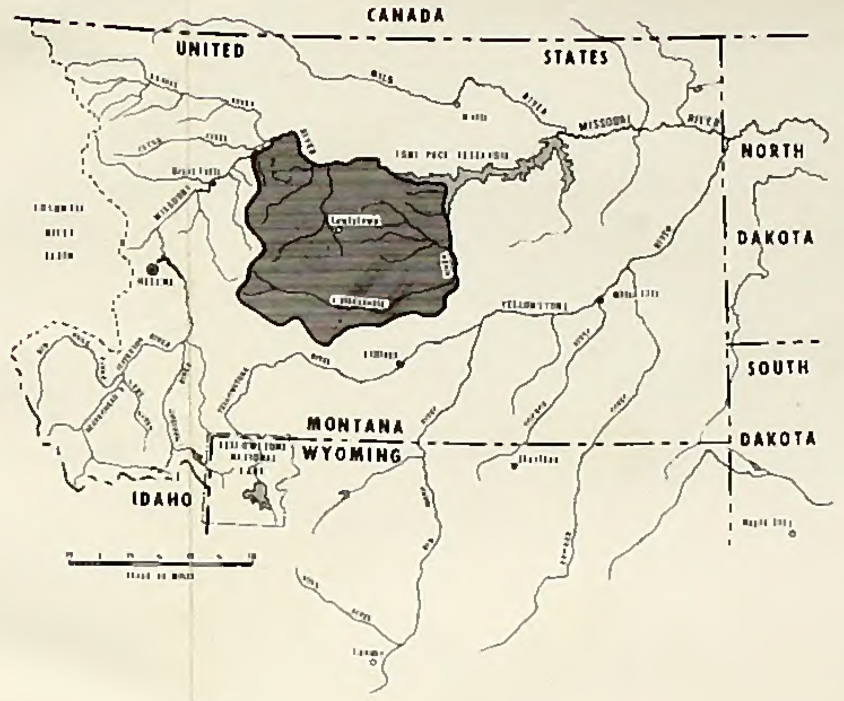

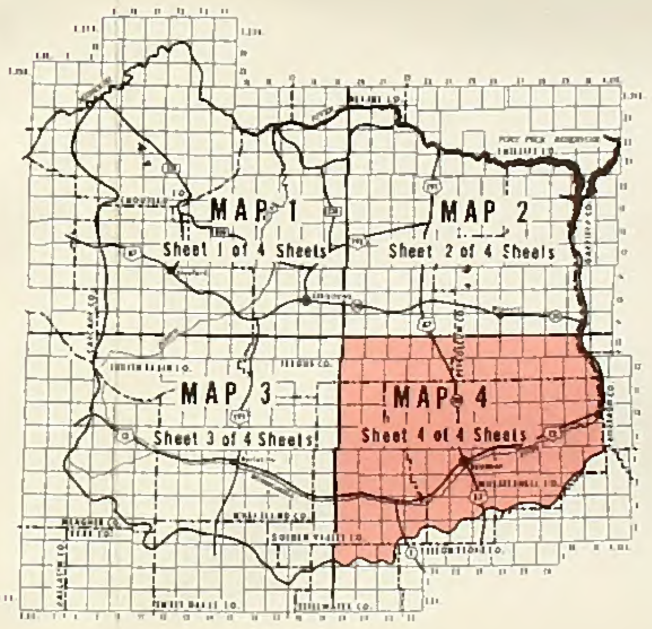

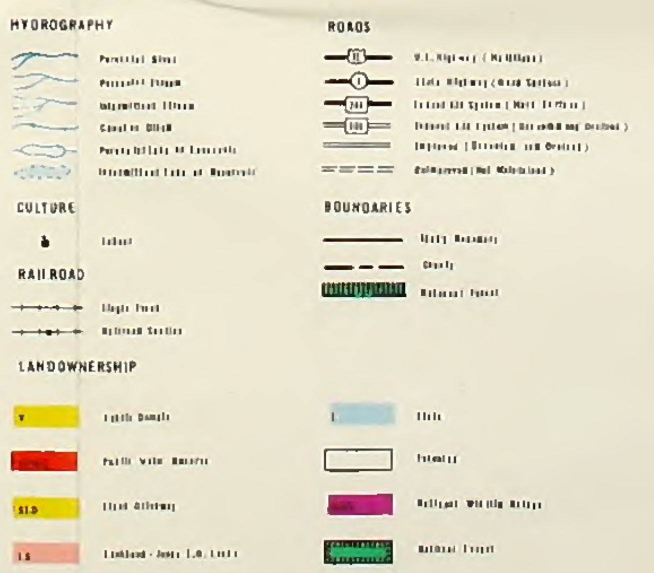

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